THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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A GOVERNMENT POLICY ANNOUNCED.

LAST week, when most minds were preoccupied with the serious question of the unnaturalised alien within our borders, Mr. Asquith's announcement respecting the new policy of the Government in this matter received so much attention in the Press that we were in danger of overlooking the importance of a speech from the lips of the Right Hon. J. A. Pease, which followed at a later stage of the same sitting of the House.

Mr. Pease was making the annual statement regarding the work of the Board of Education and its various establishments, and after having paid a fitting tribute to the Universities, London and Provincial, for the large number of their students who have joined the Colours, he entered upon a matter of supreme importance to the industrial future of this country, and announced a policy which proves that the appeals that have been made to the Government to consider some of the possible after-effects of the war upon our manufacturing industries have not fallen upon deaf ears.

The Government, it appears, has decided to proceed immediately with the appointment of an Advisory Council on Industrial Research, and Mr. Pease is in search of a Committee of experts who will consult with other expert Committees working in different directions. These expert Committee-men will, in turn, associate with leaders of industry, and in the whole matter "the Department"—we are not sure whether this means Mr. Pease's own department or the Advisory Council itself—will work in close co-operation with the Board of Trade. Mr. Pease proceeded further to state that he was then considering names, and hoped that the Advisory Council would be at work within a few weeks.

Readers who have closely followed our articles relating to the war since August last will remember that we have on several occasions dealt in some detail with the necessity for such a course being adopted by the Government, in view of the many and peculiar new problems that have presented themselves in connection with certain manufacturing industries consequent upon the state of war. We need not recapitulate our own suggestions now—they will be found in detail in our issue of October 23rd, 1914—but we congratulate the Government upon having found time in these very trying Parliamentary days to take steps which, at any rate, form an excellent beginning.

The apprehensions that many trade and industrial authorities have, that after the war is over Teutonic competition will be fiercer and still less scrupulous in its methods than it has been in recent years, are also the apprehensions of Mr. Pease, and he recognises that strong and appropriate measures must be adopted. The Government have had the matter under consideration, and have agreed that something must be done at once. It is not at all inappropriate that the announcement should emanate from the lips of the representative of the Board of Education, for in all discussion of this subject it has been most obvious that our educational

system has much to answer for in respect of our shortcomings, though, of course, there are many other and important factors as well. But after so much discussion concerning the necessities of the situation, it is gratifying that at last the serious nature of some of our industrial problems has been actually brought home to the mind of the Government, and that action is being taken. From the *Times* report of Mr. Pease's speech we gather that the Government agree that we must make more use of the workers who exist in this country; that we must prepare for an increased supply of them; that we must bring our Universities and technical schools into closer association with industries, and our leaders of industry into closer association with skilled workers. It is for these and other purposes that this Advisory Council on Industrial Research is being set up, and we are sure that the proposal, which met with a cordial reception from subsequent speakers in the House, will also be received with a general chorus of approval from both scientific and industrial authorities. As a beginning, Mr. Pease hopes to place on the Supplementary Estimates a vote of between £25,000 and £30,000 for the objects named, and in adding that the scheme must be dependent upon State help for years to come, he said that this State help must steadily progress. Two further remarks in his speech convey the idea that he has a fairly correct appreciation of the criticisms of educational authorities in recent years. For the future of the country our youth must be kept longer at school when it shows itself able to benefit by further education; and the nation must create careers for men who are capable in the scientific world to benefit therefrom.

From the foregoing it will be clear that this Advisory Council on Industrial Research will not be too closely restricted in regard to the scope of its operations. Its problems are large, its duties are of extreme importance, and the time may be short. We hope that no time will be lost in securing the best men available for the Council, and ensuring that they shall be brought into effective association with the leaders of our own and other industries, and that the promised close co-operation with the Board of Trade may enable us nationally to adopt, without any further delay, that course which shall ensure the more efficient co-operation of science and industry which is so essential if we are to render ourselves better able to hold our own against nations which have eternally disgraced themselves by their barbarities and inhumanities, and have made themselves unfit to trade with until they have rendered for ever harmless all who have been responsible for the horrible carnage of these terrible days.

In one of our early editorials on the war, we suggested the holding of a conference of electrical industrial and commercial authorities, in the hope that some organised form of pressure could by that means be brought to bear upon the Government in respect of the above and cognate matters. We gather from the annual report of the Council of the Institution of Electrical Engineers that a German Trade Committee was appointed and held a number of meetings in conjunction with representatives of the B.E.A.M.A. The following quotation from the report will explain what was the ultimate decision:—

GERMAN TRADE.

Soon after the outbreak of the war a Committee was appointed by the Council to keep in touch with the British Electrical and Allied Manufacturers' Association in regard to the question of securing for British manufacturers the trade hitherto done by Germany and Austria-Hungary. A number of meetings of this Committee were held, at which representatives of the Manufacturers' Association were present, and the position was very fully discussed.

Eventually, after several suggestions had been considered, the Committee came to the conclusion, with the concurrence of the Manufacturers' representatives, that the continuance and expansion of British trade after the war will mainly depend on economic principles and on the commercial industry and initiative of British manufacturers, and that no useful action on the part of the Institution appeared to be possible.

At first the Committee were in favour of holding a meeting for the purpose of discussing a paper on certain aspects of the competition of foreign countries, but after consideration the Manufacturers' Association were of the opinion that the result likely to to be obtained would not justify such a meeting being held, and, at their request, the idea was abandoned.

The Committee referred to above still remains in being for the purpose of advising the Council in regard to any question which may arise in the future.

We are glad to read the closing paragraph, for it is comforting to know that the Committee still *remains in being*. May we be pardoned if we await with certain anxiety the next bulletin? It will be quite excusable, seeing the absorbing interest that most electrical men are taking in the future possibilities of the industry, if the average member of the Institution wishes to inquire which is the correct authority to decide what are and what are not fit subjects for discussion in public meeting.

Inquisitiveness may even lead some to wonder whether in appointing its Council on Industrial Research the mind of the Government was influenced in any degree by any of our representative electrical organisations. If so, we think it should be known; if not—well, the credit belongs to somebody else; either the Government authorities, or some of the scientific societies which, as we mentioned in our last issue, have busied themselves with the subject of science and industry, and recently sent a deputation to the Presidents of the Board of Trade and the Board of Education.

Standardisation Rules.

When we commented on the rules for the standardisation of electrical machinery formulated and provisionally adopted by the British Electrical and Allied Manufacturers' Association just two years ago, we remarked that it would be unfortunate if every Association were to issue a set of rules on its own account, but that in view of the pressure of competition it was desirable that a uniform basis of rating electrical machinery should be established without undue delay. At that time the International Electrotechnical Commission was engaged upon this very question, and the Report of the Engineering Standards Committee on Standards for Electrical Machinery was out of date.

In the interval the I.E.C. has given great attention to the matter, and has endeavoured to harmonise the views of the British, American and German Committees, with especial reference to the temperature limits to be prescribed; as regards the German Committee, circumstances have intervened which need not be particularised, but so recently as last month an American deputation was in this country conferring with our representatives on the subject of electrical standards, and we believe substantial agreement was arrived at. The importance of international uniformity in this respect is obvious. No definite rules, however, have yet been issued in this country other than those above referred to, and therefore it is apparent that the Association was well advised in providing a set of standards for use in the interim.

A new edition, or rather a reprint, of these rules has now been issued by the B.E.A.M.A., and in the preface we are informed that owing to the impending publication of the first section of the new British standard rules by the Engineering Standards Committee, it was thought best not to introduce the changes in the Association's rules which would otherwise have been made. This decision is commendable, as it limits the confusion and disturbance due to modifications in the rules to a single set of changes. Seeing that the Standards Committee has had the matter in hand so long, it is interesting to learn that we may look for the fruit of its labours at an early date.

The B.E.A.M.A., however, has appended very considerable additions to the original code, in the form of a supplement, which we reproduce in full in this issue. It will be seen that the new sections cover a wide range, and doubtless represent a great deal of hard work on the part of the Committee charged with the duty of formulating the rules. Some interesting questions are raised by the new clauses; the introduction of "tolerances," for instance, into guarantees, and the method of determining the "average-load guarantee," are novel features. Whether in some cases the range of tolerance permitted will be acceptable to the purchaser, when the latter is himself an engineer and capable of appreciating exactly the value and meaning of the limits specified, is open to question.

It will be borne in mind, of course, that these rules are primarily designed for the use of the manufacturer, and

while we do not suggest that they are prejudicial to the interests of the purchaser, it is not to be expected that they shall err in his favour.

Some of the rules savour rather of the text-book, such as those relating to cyclic irregularity and to the use of reactances for the protection of alternators; Section X, in fact, can hardly be said to embody anything in the nature of standardisation.

An excellent feature of the code is the provision of distinctive and uniform markings for the terminals of machines and transformers, and of conventional symbols and letters for switchgear and instruments; it is to be hoped that these will meet with general acceptance. Other countries have long had in operation codes of symbols for wiring diagrams, &c., and it is very desirable that uniformity should be attained in this respect, as in the use of symbols in formulæ, which has already been dealt with by the I.E.C.

While representing the views of only one section, though a very important and influential section, of the industry, and to be regarded rather as a temporary system pending the issue of a code of rules by the Engineering Standards Committee that will be acceptable to all parties, the Rules of the B.E.A.M.A. are to be welcomed as a praiseworthy and practical effort to amend a very marked deficiency in our industrial organisation. We take it that they are not put forward as rigid and immutable standards, but as a working basis for friendly agreement between the parties to a commercial transaction, and we have no doubt that in this sense they will be favourably received by the industry.

Copper.

The tone of the copper market has been hardly so good, but this has arisen apparently not because of any rift in the situation, but as a reflex of the dastardly outrage of the German Admiralty, acting, no doubt, under the direct instructions of the Arch-Hun, upon the *Lusitania*, and of the political conditions arising therefrom. Of course, no man living can say whether the American President is again bluffing hard, or whether he really does resent the murder of American citizens on the high seas, with which policy Germany has familiarised the world during the past six months, but if he is not engaged in a game of poker, we should be approaching the time when Germany will have to introduce some surface gloss of civilisation into her methods, which may in turn create an altered situation. With the civilised world determined to wipe out the Hun and his practices, the consumption of copper must go on regardless of temporary fluctuations, produced by what, after all, are mainly sentimental considerations. All that the murder of women and children, and the crucifying of wounded really involves, is the further and further wiping out of existence of the perpetrators of nameless outrages, and all this means that copper must be used in ever increasing quantities.

There has been less activity in demands lately, but the restriction of buying on the part of consumers is always inevitable whenever the standard market wears an appearance of reaction. The actual consumption going on increases steadily, and buying will be impelled from time to time, as orders for ammunition and other work are being increased. The position in the United States has improved considerably as regards consumption, largely owing, of course, to the heavy orders which have been booked by American cartridge makers in connection with the requirements of the belligerents, and the brass trade across the Atlantic is now experiencing a degree of activity and prosperity to which it has been a stranger for years. Meanwhile, production continues to progress steadily, and, indeed, every effort seems to be strained to increase output owing to the exceedingly profitable nature of the business. There can be no diminution in consumption for war purposes, and although there may be a lull in new buying when the war ends, this can be only a temporary measure, for the replacement of damage and the ordinary extensions which have been held back during the war period, will then have to be dealt with, and these should account, for a time at least, for every ton of copper which the world can produce.

For the moment there is a very wide disparity between the prices of standard copper and refined material. There has been liquidation of the former, owing to the political situation in the United States, but, on the other hand, producers have shown not the least sign of wavering, and an adjustment will probably be made, by renewed confidence on the part of speculators causing a buying movement in standard copper, which will practically restore the normal relations between the two grades of material.

The Telephone Disservice.

When the proposal that the State should purchase and work the telephone system was coming to a head, we pointed out that the result of this proceeding would inevitably be lower efficiency, higher rates, and incompetent management. We endeavoured to disabuse the minds of the well-meaning but uninformed public of the idea that the State could conduct so intricate an undertaking more ably than a private concern, and by way of example we cited the disastrous records of the telegraphs, than which it would be difficult to find a more convincing illustration of State mismanagement. Our warnings, and those of others who shared our views, were disregarded, and the mischief was done; the property of the National Telephone Co. was acquired under compulsion, on terms which verged upon confiscation, and the trouble began.

To deny that the position of the telephone subscriber had changed for the worse would be shutting one's eyes to the obvious facts; the storm of protest, the agonised appeals for rescue from the tyranny and ineptitude of a State service that swept over London in 1912-13 will not soon be forgotten by the telephone department, which itself was sorely tried by the necessity of coping with the difficulties of a gigantic and complex problem with an inadequate staff, under the control of laymen. Those who hoped for an all-round reduction of rates were sadly disillusionised, as we warned them they would be; there is good reason to anticipate an increase rather than a decrease. The efficiency of the service fell so low that leading City men denounced it as a nuisance rather than an aid to business. Moreover, with the change of ownership came the accompanying change from the reasonable and co-operative methods of a commercial undertaking to the autocratic and arbitrary ways of a bureaucracy; the telephone service was no longer a convenience provided in return for a monetary consideration, but a privilege vouchsafed to those who succeeded in obtaining connections, subject to withdrawal on slight provocation and involving the user in unknown liabilities in the shape of payments for calls of unknown origin, the sole record of which was made by the Post Office staff.

Our warnings and criticisms were issued in the interest of the general public, and not on our own behalf; but we are not to escape unscathed. We have just received a notice to the effect that our telephone number, which has become as familiar to our friends as the colour of our cover, is to be changed (in August, or before) from Holborn 933 to City 997, "owing to the acquisition by the State of the late National Telephone Co.'s system," which has necessitated the rearrangement of certain of the exchange boundaries. There are no half-measures about it; arrangements are in progress for the transfer, and if we don't like it we can, of course, do the other thing. We hardly need point out to business men that the possession of a recognised telephone number, in spite of the deficiencies of the service, is something of an asset, like a known business address, and the arbitrary substitution of a new number is in effect an act of confiscation, without hope of redress.

"The Postmaster-General trusts that you will excuse any temporary inconvenience which may arise from this change"—this is the velvet glove, cynically affecting to conceal the iron hand in whose grip we are, in common with other victims of this Department of State. The Postmaster-General is adept in the use of smooth words and sugared phrases, but these afford no consolation for the injury inflicted upon us.

SOME NOTES ON SHUNT REGULATING RESISTANCES.

By THOMAS CARTER.

A recent article in the Electrical Review (March 26th, 1915), on "Potentiometer Rheostats and Rheostats with Protective Resistances," suggested to the present writer that some notes on the same subject, dealing with it from a rather more general point of view, might be interesting and useful to those who have to get out resistances of this special character frequently. Three separate sections will be treated, namely :—

I.—Potentiometer Regulators.

II.—Regulators with Protective Resistances.

III.—A Special Grading for Ordinary Regulators.

The treatment is, perhaps, more detailed and comprehensive than is required for most practical purposes, but,

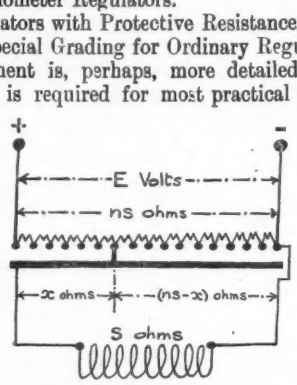

Fig. 1.

just because it is full, it will cover any case likely to arise ; and for ordinary purposes the user of the method abstracts as much as deals with average cases, and probably simplifies many of the formulæ for rapid use. As in all other processes employing formulæ, care should be taken not to use them blindly, but only after making sure that they deal with the case considered. The use of a formula without care and intelligence is certain to lead sooner or later to disaster : a formula is a good angel if a servant, but if it becomes master, it is more subtle in temptation than Satanus himself.

1. *Potentiometer Regulators.*—The standard connections of a potentiometer regulator are shown in fig. 1.

The exciting voltage, E, has across it a resistance, $n\,s$, and the field winding, whose resistance is s, is put in parallel with more or less of $n\,s$, according as its current is to be increased or diminished.

The amount of resistance in $n\,s$ is arbitrarily chosen, but it is useful, as will be seen from what follows, to choose some round value for the multiplier n, and to make $n\,s$ thus bear a simple ratio to s, for greater convenience in plotting sets of curves. The present writer was greatly interested to see the set of curves in the earlier article already referred to, as they are absolutely identical in form with those developed by him on more general lines many years ago, and used by him with great convenience ever since. The usual value of n is from 2 to 4, and the circumstances of each case generally show fairly clearly which value is most suitable.

Whatever n be, the following treatment is perfectly general, and expresses all currents in all parts of the circuit in terms of E/s—*i.e.*, of the maximum value of the field current which it is possible to obtain. Let the sliding contact of the regulator be moved to a position which gives x ohms in series with a loop consisting of $(n\,s - x)$ ohms in parallel with s ohms. Let x be q times $n\,s$ (q having any value from zero to unity). Then the total resistance between terminals is—

$$x + \frac{(n\,s - x)\,s}{n\,s - x + s} = q\,n\,s + \frac{(n\,s - q\,n\,s)\,s}{n\,s - q\,n\,s + s},$$

which simplifies to $s \,.\, \dfrac{(q - q^2)\,n^2 + n}{(1 - q)\,n + 1}$.

The total current in the circuit is therefore—

$$\frac{E}{s} \,.\, \frac{(1 - q)\,n + 1}{(q - q^2)\,n^2 + n},$$

and this is clearly the value of the current in x. The current in $(n\,s - x)$ is $s/(n\,s - q\,n\,s + s) = 1/((1 - q)\,n + 1)$ of the total, and the current in s is $(n\,s - q\,n\,s)/(n\,s - q\,n\,s + s) = (1 - q)\,n/((1 - q)\,n + 1)$ of the total, so that—

$\dfrac{E}{s} \,.\, \dfrac{1}{(q - q^2)\,n^2 + n}$ is the current in $(n\,s - x)$,

and $\dfrac{E}{s} \,.\, \dfrac{(1 - q)\,n}{(q - q^2)\,n^2 + n}$ is the current in the field winding.

The curves in fig. 2 are plotted from the above expressions, the ordinates representing currents in terms of E/s, and the abscissæ values of x from zero up to $n\,s$—*i.e.*, from $q = 0$ to $q = 1{\cdot}0$. The value of n chosen for these particular curves is 3·5.

The following table gives the values (with n indeterminate) of the current in the three parts of the circuit for various values of x.

$x = q\,n\,s$.	Current in $(n\,s - x)$.	Current in x = total current.	Current in s = field current.
0	$E/s \,.\, 1/n$	$E/s \,.\, (n+1)/n$	$E/s \,.\, n/n = E/s$
·1 ns	$E/s \,.\, 1/(\cdot09n^2+n)$	$E/s \,.\, (\cdot9n+1)/(\cdot09n^2+n)$	$E/s \,.\, \cdot9n/(\cdot09n^2+n)$
·2 ns	$E/s \,.\, 1/(\cdot16n^2+n)$	$E/s \,.\, (\cdot8n+1)/(\cdot16n^2+n)$	$E/s \,.\, \cdot8n/(\cdot16n^2+n)$
·3 ns	$E/s \,.\, 1/(\cdot21n^2+n)$	$E/s \,.\, (\cdot7n+1)/(\cdot21n^2+n)$	$E/s \,.\, \cdot7n/(\cdot21n^2+n)$
·4 ns	$E/s \,.\, 1/(\cdot24n^2+n)$	$E/s \,.\, (\cdot6n+1)/(\cdot24n^2+n)$	$E/s \,.\, \cdot6n/(\cdot24n^2+n)$
·5 ns	$E/s \,.\, 1/(\cdot25n^2+n)$	$E/s \,.\, (\cdot5n+1)/(\cdot25n^2+n)$	$E/s \,.\, \cdot5n/(\cdot25n^2+n)$
·6 ns	$E/s \,.\, 1/(\cdot24n^2+n)$	$E/s \,.\, (\cdot4n+1)/(\cdot24n^2+n)$	$E/s \,.\, \cdot4n/(\cdot24n^2+n)$
·7 ns	$E/s \,.\, 1/(\cdot21n^2+n)$	$E/s \,.\, (\cdot3n+1)/(\cdot21n^2+n)$	$E/s \,.\, \cdot3n/(\cdot21n^2+n)$
·8 ns	$E/s \,.\, 1/(\cdot16n^2+n)$	$E/s \,.\, (\cdot2n+1)/(\cdot16n^2+n)$	$E/s \,.\, \cdot2n/(\cdot16n^2+n)$
·9 ns	$E/s \,.\, 1/(\cdot09n^2+n)$	$E/s \,.\, (\cdot1n+1)/(\cdot09n^2+n)$	$E/s \,.\, \cdot1n/(\cdot09n^2+n$
1·0 ns	$E/s \,.\, 1/n$	$E/s \,.\, 1/n$	$E/s \,.\, 0/n = 0$

If curves be plotted, similar to those in fig. 2, but for other values of n, say 2, 2·5, 3 and 4, this set of curves will cover practically all possible cases that can arise. These curves are clearly of a more generally applicable nature than those shown in the earlier article, as the latter apply to certain definite currents in amperes and definite resistances in ohms, while those here described, being based on fractional values of a perfectly general total, are of perfectly universal applicability. The only constants required for any case are E and s, which are given, and n, which is suitably chosen. The value of the field current required at

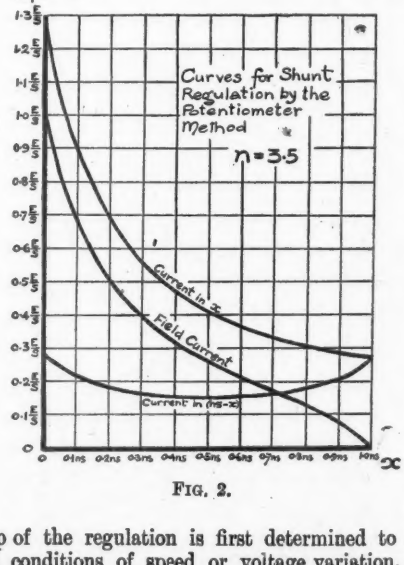

Fig. 2.

each step of the regulation is first determined to suit the specified conditions of speed or voltage variation. These successive values of field current are tabulated as fractions of E/s, and from the curves the corresponding values of x, as a fraction of $n\,s$, and current in x, as a fraction of E/s, are obtained. By multiplying these two sets of figures by $n\,s$ and E/s respectively, the required resistance in ohms and capacity in amperes of the steps of the regulator are obtained. A numerical example is scarcely necessary, as the simplicity of the method is obvious.

For a case like a booster, it is, of course, permissible to reduce the field current to zero ; but in the case of a motor, there will usually be a limiting value below which the current should not be reduced. This means that not all

of $n\,s$ should be variable, but that a certain part should be arranged as a last step, not capable of being cut out, of such a value as will give the required field for the maximum speed specified. If this be not done, there is the danger that the field may be made to disappear altogether, with disastrous results for the motor.

The use of a potentiometer regulator clearly diminishes the efficiency of the machine it is used with. Hence n should be kept as great as possible, so as to reduce the additional loss in the regulator as much as possible. But, on the other hand, if $n\,s$ be abnormally large, it may lead to a very bulky resistance, as the regulator has always to carry a current greater than the field current. The choice of n is therefore, as in so many cases, a compromise between two opposing ideals, and experience is the best guide in making the selection. The most usual range of values has, however, already been indicated.

(*To be continued.*)

THREE-PHASE ELECTRIC CRANES AT THE PORT OF BORDEAUX.

TRAFFIC to the port of Bordeaux has increased very rapidly during recent years, some indication of its growth being given by the fact that 116 goods-handling machines of various types worked nearly 140,000 hours in 1912, as compared with 51 machines working 36,000 hours in 1902; and during the first six months of 1913 the weight of merchandise handled was 2,230,000 tons, or 28 per cent. increase on the corresponding figure for 1912. On the extended Queyries wharves, the No. 2 wet dock, and in the elaborate silo and transporter equipment erected to serve warehouses and the coal yards of the Paris-Orleans Railway, electrical equipment has been adopted very extensively, and has resulted in marked acceleration and cheapening of operation. According to *La Revue Electrique*, six large electric cranes are now installed on the Queyries wharves, each capable of raising 3,300 lb. at 235 ft. per min.; 6,600 lb. at 160 or 235 ft. per min.; or 11,000 lb. at 160 ft. per min. The range is 34 to 46 ft., according to the inclination of the jib; the speed of crane rotation, 2 R.P.M.; speed of translation, 40 ft. per min.; total travel of hook, 100 ft.; centre of jib pulley above rails at maximum radius, 60 ft.; gauge of rails, 9 ft. 3 in. In each case a double drum windlass is provided, permitting the use of three-cable grab-buckets (two cables for lifting, one for opening), and so arranged that the lifting drum can be used alone for loads up to 11,000 lb., or the auxiliary drum alone for loads up to 6,600 lb. The grab bucket can be raised or lowered when open or shut; and can be opened or shut at any point in its travel whether full or empty. Of the 14 electric cranes at the No. 2 dock—five have 46-ft. radius and lift up to 6,600 lb. by single cables; five otherwise similar cranes have three-cable grab-bucket gear; and four of 46-ft. radius, lift up to 11,000 lb. in three-cable grab-buckets.

Three of the Queyries cranes use compressed air at 90 lb. per sq. in. to operate brakes and couplings, but three later cranes include, among other improvements, all electric operation of auxiliary parts. The mechanical features of the latest hoisting gear are particularly simple. A heavy foundation plate carries both drum shafts on ball bearings, the latter being used to reduce maintenance, increase efficiency, and permit light loads to descend easily without current. The front shaft carries the main drum; the rear shaft carries the auxiliary drum, driving gear and cone clutch. Between the drum shafts is a countershaft, driven electrically through a band brake coupling which is closed only during hoisting. On this shaft are two loose pinions, provided with claws which may be engaged with corresponding countershaft claws, the latter being operated simultaneously or independently by the driver. As a result, the drums may be driven simultaneously or independently, and any desired combination of movements can be easily secured.

The main drum is driven through a geared rim, the auxiliary drum through a large leather-faced cone. The latter has a "counter-cone" so that, when working with grab buckets, the release-cable is tightened during closing, and no time is wasted when the bucket is to be opened. A motor-brake engages the cone of the auxiliary drum, liberates it (leaving the drum free), or engages with the counter-cone while closing the grab. The winding drums are 700 mm. in diameter, grooved, and each is provided with a long-arc, band-brake drum. The front drum has two 20-mm. cables and the other drum a single 22-mm. cable, which is used to open and close the grab or to lift loads up to 6,600 lb. On the end of the intermediate shaft opposite to the coupling, is an automatic brake preventing running back of the load during hoisting, due to current failure or other cause. All brakes and couplings are actuated by small 100-volt, single-phase, series commutator motors, the energy consumption of which is kept down to a minimum by suitable brush displacement. Compressed air is supplied to the brakes and clutches of the three older Queyries cranes by an electrically-driven compressor.

The mechanical features of the older cranes are less simple, an intermediate change-speed gearing being employed to suit various loads. In the later cranes, three-phase series commutator motors are used (instead of ordinary induction motors) in order to secure automatic speed variation in inverse proportion to the load.

Three-phase current at 440 volts, 50 cycles, is taken from distribution boxes connected in underground cables, by a cable coiled on an automatic paying-out drum, which takes up all slack and permits 66 ft. travel of the crane on either side of the distributing box. From slip-rings on the cable drum, current is taken through rings on the pivot and brushes on the turning part of the crane to the cabin switchboard.

The jib is elevated through double worm gearing by a 4·5-KW., 1,000-R.P.M., 440-volt motor, and its position at any moment is shown automatically by an indicator in the driver's cabin. Slewing is effected by a 7·5-KW., 1,000-R.P.M. motor driving a worm gear and pinion, meshing with a circular rack on a track 12 ft. in diameter. Another 7·5-KW. motor propels the crane as a whole through worm, parallel and bevel gears. These three motors are asynchronous machines; the slewing motor is open, the others are enclosed and further protected by sheet metal hoods. The winch motor is an open-type 52-KW., 200-R.P.M. machine, with ball-bearings; its commutator gives no trouble in service. The 100-volt, single-phase auxiliary motors are supplied through a transformer in the cabin.

Ordinary rheostatic control being inapplicable to three-phase motors, two systems were tried in the first three Queyries cranes. In each case a single lever controller is arranged so that pushing the lever forward starts and couples the hoisting motor, while completely releasing the brakes; and pulling the lever backwards releases the brakes progressively for lowering loads without current. In two cranes fitted with asynchronous hoisting motors, the control lever actuates an ordinary grid resistance controller, but in the third crane, using a series commutator winch motor, the controller is connected to the tappings of a variable voltage transformer. In both cases the control lever operates the air brake and clutch valves simultaneously with the electrical connections.

In the newer cranes, all driven by three-phase series commutator motors, the control lever operates a quick-acting reversing switch, and also through a toothed sector, the rotating winding of a variable ratio static transformer, which is mechanically balanced in all positions of the control lever. A simple means is thus provided for varying power and speed, according to requirements; resistance losses are reduced to an absolute minimum.

The acceptance test on these cranes demanded that full load be raised 6½ ft., rotated 10° and lowered to earth; then raised to 33 ft., swung through 170° and lowered; after which the empty hook was to be raised 33 ft., swung though 170°, lowered to 6½ ft., swung through 10° and lowered to earth. The guaranteed mean consumption for this performance was 400 watt-hours, with 11,000 lb. load, and 274 watt-hours, with 6,600 lb. The actual consumption averaged less on 10 tests.

Of the nine three-cable cranes alongside the No. 2 dock four are of 11,000 lb. maximum capacity, and identica with the newer Queyrie cranes. The other five are 6,600 lb cranes, similar to the above but reduced in dimensions in the ratio 7 : 6, and fitted with 37-KW., 280 R.P.M., hoisting motors instead of 52-KW., 200-R.P.M. machines. There are besides five 6,600-lb. single-cable cranes with 600-mm. drums. An automatic brake prevents running back during hoisting, and is released by hand when lowering loads. The main band brake is motor controlled, directly during hoisting, progressively during lowering. The band coupling is also motor-operated and acts only during hoisting. All shafts run on ball bearings and the motor is completely uncoupled during lowering so that, with only 130 lb. weight on the hook, a "light" lowering speed of 400 ft. per min. is quickly attained.

The hoisting motor develops 37 KW. at 280 R.P.M., and is a 440-volt three-phase series commutator machine. Variable voltage control is again adopted in preference to brush shifting (which offers mechanical difficulties) to secure speed variation from 60 to 200 ft. per min. hoisting full load; and up to 265 ft. per min., hoisting half load. The brake and coupling motors are single-phase, 100-volt series commutator motors regulated by brush displacement. Motors for jib elevation and slewing and crane propulsion are of the three-phase slip-ring, induction type.

The two latest 330-ft. berths on the Queyries wharves are equipped with seven electric grab-bucket, travelling transporter bridges, a line of reinforced concrete storage hoppers and two aerial transporter systems, one running to the Paris Orleans Railway coal yards, 1¼ miles away, and the other serving warehouses and yards along the quay. This equipment has been erected at a cost of about £80 000 specially to expedite the discharge of heavy cargoes, and to reduce handling to a minimum. The wharf transporter bridges permit at least 300 tons per hour of coal to be discharged through four hatches and dumped directly in the silo bins. The total hopper capacity (in 24 bins) is about 2,200 tons for each berth.

Coal is discharged from the bottom of the silos into railway trucks beneath, or into the buckets of one of the aerial electric transporters, each of which conveys 200 tons an hour at an average speed of 2·75 M.P.H. The total coal tonnage handled for the Paris-Orleans Railway is about 400,000 tons per annum, the charges for wharf, crane, silo and transporter service averaging 4d. to 4·13d. per ton. The new berths with their electrical equipment practically double the effective capacity of the wharves. At least 500,000 tons per annum can be discharged through each new berth, as compared with 186,000 tons per annum for each of the seven older berths equipped with travelling cranes discharging directly into railway wagons.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

The Lock-Out Contactor.

THE BRITISH WESTINGHOUSE CO., LTD., of Trafford Park, Manchester, have recently put on the market a control system known as the "Series Lock Out Contactor system," which possesses the advantages of the series relay, but eliminates its weak point, *i.e.*, the relay contact. The feature of this contactor is that it "locks out," and will not close, when the current is *above* the value at which it has been set, resistance being cut out only when the current has fallen to a predetermined value.

Motor current passes through the operating coil winding directly; with the contactor in the open position (shown in full lines, fig. 3) at the instant of applying current, assuming this current to be above the value at which the contactor should close, a flux will pass through the main air gap, through the armature, and along the steel piece A fixed to the armature and carrying the adjusting plug, through the small air gap, and on to the base. This flux tends to hold the contactor open, due to the pull between the plug and the frame being greater than the pull at the main air gap. For a fraction of a second current is prevented from passing through the part marked "saturated section," due to the very heavy damping coil which is wound round this.

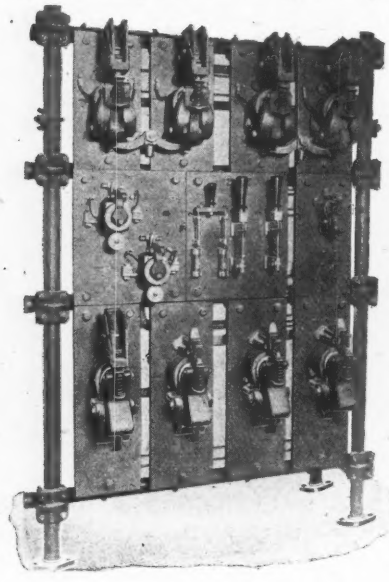

FIG. 1.—COMPLETE CONTROL PANEL.

FIG. 2.—LOCK-OUT CONTACTOR.

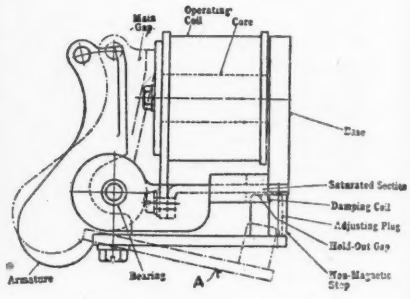

FIG. 3.

BRITISH WESTINGHOUSE SERIES LOCK-OUT CONTACTOR SYSTEM.

As the current falls, due to the motor speeding up, the flux through A decreases, but the flux through the saturated section remains the same; in consequence, the pull between the plug and the base decreases, until the pull through the main air gap overcomes it, and the contactor closes.

Without the damping coil the contactor would close as the current was rising, upon it reaching the value at which it was set to operate. But owing to the damping coil the flux is prevented from passing through the saturated section, and consequently it all passes through the adjusting plug, and the contactor cannot close. In a fraction of a second after the current reaches the full value, the flux divides between the two circuits, and the contactor is held out by the normal operation of the Lock-Out device. It is free to close when the current falls to the value for which the contactor has been adjusted.

An ordinary non-reversing automatic starter embodying this type of contactor would contain, firstly, a shunt-wound contactor; secondly, a number of contactors of the type described above, to short-circuit the resistance in the armature circuit. These contactors are so connected that without the use of any interlocking contacts each contactor is put into circuit, and consequently closes in the order desired. Also the different contactors have their coils short-circuited, and consequently fall out as the next step of resistance to them is short circuited, so that in the "full on" position only the shunt-wound line contactor and the last series-wound contactor are in circuit.

In order to keep the shunt coil as nearly as possible in line with the series coils as regards reliability, it is wound for a low voltage, and a resistance is connected permanently in series with it.

In comparison with other forms of automatic control gear, the Series Lock-Out system offers the following advantages:—

1. The number of shunt coils is reduced to a minimum. These shunt coils are never subjected to the full voltage of the circuit, as in the case, at least momentarily, with most other types of control gear.

2. No dash-pot retarders are used, the acceleration, as explained above, being fixed by the load on the motors.

3. Small interlock contacts and switches for cutting in an economy resistance are not necessary.

Terminal for Portable Accumulator.

Mr. B. Barber, engineer to the Oulton Broad Electricity Co., Ltd., finding that many ignition cells and other portable accumulators that were placed in his hands for charging had lost their terminals, or had terminals badly corroded with acid, and being dissatisfied with the makeshift of soldering a terminal on the lug, has devised a neat repair terminal, for which he has obtained provisional protection. Incidentally, he points out that the terminals usually fitted, with a metal stud embedded in the lead lug, are crude and easily twisted off. The component parts of the device are illustrated in fig. 4; they consist of a screw A with a

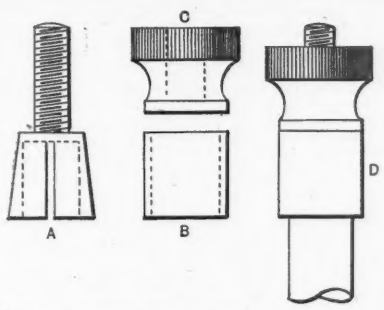

Fig. 4.—Terminal for Portable Accumulator.

tapered and slotted base, a ferrule B fitting over the latter, and a milled nut C. The end of the lug is cleaned and filed up to fit the inside of the base, which is bored parallel; the base is then put on the lug, and the ferrule B is slipped over the tapered exterior of the base and forced home with the nut, thus squeezing the slotted base tightly on the lug and gripping the latter firmly. The terminal is shown on the lug at D; it can easily be attached by the user of the battery, and forms a sound and permanent repair. We understand that Mr. Barber wishes to dispose of the right to manufacture the device.

LEGAL.

Chester Corporation *v.* Chester Water Works Co.

In the Chancery Division on Tuesday, Mr. Justice Eve heard an applicatian for an injunction by the plaintiff Corporation to restrain defendants from pulling up streets in the city to lay electric cables to the river side.

Mr. McMorran, K.C., for the Corporation, said as Mr. Dighton Pollock, for the defendants, would give an undertaking not to proceed with the work for a fortnight, he would consent to a postponement of the trial for that time.

British Vacuum Cleaner Co.'s Appeal Dismissed.

Judgment was given in the House of Lords on Monday (May 17th) in the appeal by the British Vacuum Cleaner Co., Ltd., against an order of the Court of Appeal in favour of the respondents, Messrs. James Robertshaw & Sons, Ltd., in which judgment was reserved on April 26th, as already reported by us, page 613 *ante*.

The Lord Chancellor, in giving judgment, said the action was brought by the British Vacuum Cleaner Co., as plaintiffs, to restrain infringement of a patent, granted to Hubert Cecil Booth, for improvements relating to the extraction of dust from carpets and other materials. The defence was twofold: first, non-infringement; and, secondly, prior publication and user. The patent had been on several occasions before the Courts in other cases, and this House had decided that it contained a sufficient subject-matter, and was to be construed in a particular sense. It was, however, open to the defendants to prove anticipation as well as non-infringement, and the Court of Appeal, by a majority, reversing the judgment of Mr. Justice Sargant, sitting as Judge in the Chancery Division, decided in favour of the defendants on the question of non-infringement.

The appellants' invention consisted of the combination of an extracting implement and a power-driven suction pump, by means of which a considerable vacuum was obtained and dust laden air drawn into the machine. Prior to the appellants' invention there had been on the market an apparatus for removing dust by suction, but in that apparatus the suction was obtained by bellows as distinguished from a cylinder pump, and its object was to remove dust from the surface only, a process which required but moderate suction.

The conclusion his Lordship came to was that the decision of the majority of the Court of Appeal was right. The appellants had limited their claim to an apparatus capable of maintaining a pressure of at least 5 lb. at the nozzle and the respondents' machines did not come within the patent so interpreted. Accordingly, he moved that this appeal should be dismissed, with costs.

Lords Strathclyde, Parker and Parmoor read judgments to the same effect, and Lord Sumner expressed his entire concurrence in the result arrived at.

Accordingly, the appeal was dismissed, with costs.

Electrical Apparatus Co., Ltd., *v.* Canadian British Engineering Co, Ltd.

In the City of London Court on Tuesday, before his Honour Judge Atherley-Jones, K.C., an action was brought by the Electrical Apparatus Co., Ltd., Vauxhall Works, South Lambeth Road, against the Canadian British Engineering Co., Ltd., 4, Queen Victoria Street, to recover £70 18s. 6d., which consisted of £43 15s. 1d. for electrical goods supplied and £27 3s. 5d. for goods bargained and sold, and damages for refusing to accept delivery under the Sale of Goods Act.

It seemed that the defendants ordered the plaintiffs to dispatch one 10-ampere single-phase meter, 110 volts, to Ontario, and a similar one to the defendant company's office in Winnipeg. Plaintiffs had the goods specially manufactured for the defendants, and then asked for special instructions about delivering them.

Mr. Taylor, the plaintiffs' secretary, said they telephoned to the defendants that the goods were ready for shipment. They had never been able to receive the necessary instructions, with the result that the goods were on their hands. There was no available market for them as they were made specially for the defendants.

The Secretary of the defendant company said they could not pay at present. Ninety per cent. of the company's creditors in Canada and the greater part of the creditors in England had agreed to a scheme whereby they were to have six months' extension of time. If judgment was given for the plaintiffs in that case, the defendant company would have to go into liquidation, and the plaintiffs were the only creditors who were pressing them.

Judge Atherley-Jones said he did not want to break up the defendant company, and no doubt the plaintiffs would meet them in a reasonable way.

Mr. Taylor replied that a meeting had been held of the defendants' creditors in Canada without any reference to the plaintiffs, and there had been no formal meeting in England at which they could attend to discuss the defendants' financial position. They did not consider they were deserving of any consideration, having shown none to the plaintiffs. They did not wish to act vindictively.

Judge Atherley-Jones, K.C., said he did not think they did. He must give judgment for the plaintiffs for £67 3s. 6d. The Canadians had deserved well of this country, and therefore the defendants should receive every consideration.

Electric Furnaces in Italy. — Recently published statistics relating to the number of electric furnaces in Italy up to 1913, show that they are in use by four establishments engaged in iron smelting and ten in other industries. Of the former, the Dalmiene works at Bergamo have doubled their plant, and their output of iron piping is now 30 tons yearly. The plant comprises two Héroult furnaces. The Tranchi-Griffin works at Brescia is considering the introduction of a Stassano electric furnace for the production of cast-steel. The Darfodelle Ferriere works at Volta has continued the production of foundry iron with a 3,000-kw. Héroult furnace; it also produces fine iron, ferro-manganese, ferro-silicon, and carbide of calcium with three Keller furnaces of 1,500-kw. capacity, four of 750, and two of 75, adapted to each purpose. In the Milan works of the Acciaierie Milanesi, two Stassano furnaces are in steady operation. At Turin the Fonderie Riunite is obtaining good results from the Bassanese furnace, which is of the arc type like the Stassano.

Of electric furnace installations employed in other industries, there is the installation at the works of Prof. Rossi, of Legnano, whose capacity was doubled in 1913. It consists of 18 furnaces of 500 kw. at 4,000 volts, used for the fixation of atmospheric nitrogen, and a small furnace of 120 kw., employed in making an alloy called "Elianite," invented by Prof. Rossi, which is fusible like iron, but absolutely unattackable by acid. In the manufacture of aluminium the Bussi Works treated in 1913 over 6,000 metric tons of bauxite, yielding 874 metric tons of metal. Of carbide, the Darfo Works, with their Keller furnaces, turned out about the same quantity as the preceding. In the neighbourhood of the Italian capital a much greater production was effected—some 34,000 metric tons (against 26,000) in the several works at Foligno, Anversa, Narni, Papigno, and Collestatte. The Foligno Works have now given up this branch of production, and devote their energies to ferro-silicon, but a new carbide factory, employing three furnaces of a total capacity of 2,250 kw., has been started at S. Giovanni Lapatoto. Calcium cyanamide is also produced at Collestatte, to the extent of 12,600 metric tons Lastly, electric carbons are manufactured at Narni, the output in 1913 totalling 18,000 metric tons.

WAR ITEMS.

Electric Motor Lorry at Erith.—Messrs. Vickers, Ltd., have just put into service a 3½-ton Baker electric motor lorry in connection with their works at Erith, Kent. It is to be used for the transport of war material to Woolwich Arsenal and Dartford and for the collection of goods from the railway station.

Board of Trade Publications.—The C.I. Branch of the Board of Trade has issued No. 20 of its lists of inquiries for the sources of supply of goods for the week ended May 8th.

An Australian Charge.—Reuter's correspondent at Adelaide says that, on May 14th, Mr. Justice Gordon decided that there was no case to go before a jury in connection with the charge brought against Mr. Francis Hugh Snow, a well-known merchant, of attempting to supply copper ores to a firm in Germany. The accused will probably be prosecuted on another charge.

Carbon-making in Australia.—An Austrailan paper states that a company, to be known as the Australian Arc Carbons Co. Pty., Ltd., has been formed, with an authorised capital of £4,000, in 400 shares of £10 paid up, for the local manufacture of carbons of the kind extensively used for cinema shows, naval searchlights, railway arc lamps, municipal lighting, and various electrical influence machines. "In the past these have been largely imported from Germany and Austria. The secretary is Sir Alexander Peacock, 339, Collins Street, and the sole distributing agents are Messrs. Newby & King, National Mutual Buildings, Collins Street, Melbourne."

Russian Demand for Electric Fittings.—A Petrograd paper says that with the opening of the building season the question of the scarcity of electrical materials becomes a very acute one. The previously existing supplies of sundry accessories for installing electricity, as the demand throughout the winter was not reduced, have considerably declined, and the question now is one of making up the supplies. Local factories that engage in producing such goods are so overwhelmed with large and urgent orders that the production for stock, or for the market, is reduced to a minimum, and the Moscow factories are unable to satisfy the demand. The large increase in Customs duties is having its effect upon the prices which, for the most part, are up from 30 to 40 per cent. For want of raw material the production of batteries too has been very much curtailed. There is no carbon for arc lamps. Very satisfactory offers of installation material have been received from America, but the conditions of sale are not suitable to the Russian market. The proposals submitted at the council of electro-technicians held in January this year, to manufacture in Russia some of the more generally used types of fittings in place of those previously imported from Germany, have not yet materialised, because, as stated above, the Russian factories are overwhelmed with important orders. The demand at the moment is not important, but it is expected to become so in a few weeks' time.

Government Cable Contracts.—Among the Parliamentary questions, asked on May 13th, was one put to the First Commissioner of Works by Mr. Booth, who asked if Julius Hirschmann was still a director of the Union Cable Co., which received a Government contract; if he was a nominee of the Deutsche Kabelwerke A. G., Berlin; and where he was now residing. Mr. Walter Rea, in reply, stated:—"So far as the information in the possession of the Office of Works shows, Julius Hirschmann is not a director of this company. His place of residence is not known."

The following letter has come to hand just as we go to press:—"I do not know your correspondent, Mr. A. R. Munday, and have no wish to reply to his letter, but since so much publicity has been given to the matter, perhaps it is well our friends should know that five-sixths of the work we have in hand at the present moment is on direct Government contracts for various departments. So long as the Government offer us work, we shall carry on, in the belief that we are patriotic, and allow the Board of Trade and its Supervisor to look after any profits there may be. I trust you will be good enough to publish this letter.—J. A. Blackwood (on behalf of the employés of the Union Cable Co., Ltd.), Dagenham Dock. May 19th, 1915."

The Lighting of London Streets.—At the Lambeth County Court, before Judge Parry, on Friday, George Brown, a taxi-cab proprietor, brought an action against the Lambeth Borough Council to recover damages for injuries to a cab. It was stated that, after emerging from the glare of a shaded gas-lamp at Brixton, plaintiff was plunged into total darkness, and ran, a short distance away, into a refuge, on which was an electric arc lamp. At the time of the accident this electric lamp was out, the result being that the driver smashed the lamp column and damaged the car. Evidence was called to prove that the electric lamp on the refuge was out at the time of the accident, and that it was practically impossible for a driver to see the refuge after he had come from the glare on the road caused by the shaded gas lamp. A police-sergeant stated that it was so dark that he had to go into the cab and turn up the light in order to make a note of the accident. Mr. Bruce Penny, Town Clerk of Lambeth, for the defence, maintained that there was no negligence on the part of the Council, inasmuch as the lighting arrangements were carried out by the gas company and the South London Electric Supply Corporation. He also pleaded that the Council was not responsible for the accident, as it was acting under the instructions of the Chief Commissioner of Police, who was responsible for the lighting of the streets under the Defence of the Realms Act. Mr. H. C. J. Edwards, the borough engineer for Lambeth, stated that the lamps had been shaded at the instigation of the police, who approved of the measures taken by him and his staff. It was desired that the lights from the lamps should be thrown on the ground, but that did not cause a glaring light. It was common knowledge that the whole of the lighting of London had been taken out of the hands of the local authorities, and that the police were responsible for it. Evidence was given that the electric arc lamp should have been in working order at the time of the accident, and that it should have been alight, as it was found to be burning at eleven o'clock on the morning after the accident. Mr. Lever pointed out that under a recent decision in the High Courts, when a similar action was taken against the Poplar Borough Council, the Council was responsible for an accident of this nature. Judge Parry said, in view of the importance of the case, he should reserve his decision.

Limiting Municipal Expenditure in War-time.—The Finance Committee of the L.C.C. has reported to the Council at some length on the subject of the restriction of capital expenditure. The object of the Treasury is to conserve and direct into channels useful to the nation for the furtherance of the war both the capital and the labour of the nation, and it is desired by their lordships to stop or reduce capital expenditure by local authorities rather than merely to restrict fresh borrowing. The Committee has considered the matter in order to report what action should be taken to comply with the spirit of the Government's suggestions, and it concludes that the general principle to be observed is that all capital expenditure not necessary for the furtherance of the war should be postponed; in other words, that municipal or local interests must be subordinated to national interests. The Committee says:—"One exception only is specifically allowed, viz., urgent works connected with the public health; but the Treasury will apparently give a somewhat broad interpretation to the expression 'furtherance of the war' which will allow of expenditure on any municipal service which, if not carried on, would hamper those engaged in industries directly concerned with military requirements. It is possible that the approval of the Treasury might be secured to expenditure on isolated purchases of property in cases in which specially favourable opportunities occur, as such expenditure makes no demand on labour, but the actual payment of the purchase money should be postponed, if possible. Further, expenditure on works in progress under existing contracts will only be allowed if, after due inquiry and consideration, it appears that such expenditure cannot be postponed or delayed." A letter from the Treasury, dated 28th April, indicates another ground—extreme urgency, which may influence them in granting sanctions, for it says:—"With regard to the proposed expenditure of £88,000 on providing two additional turbo-generators at the Greenwich generating station, My Lords recognise that this is a service of urgent importance which cannot be deferred indefinitely, but they would ask that the London County Council should further consider whether it is not possible to postpone the expenditure consistently with safety for (say) six months or a year. They will not refuse sanction for the borrowing of the money if and when the London County Council determine that it is absolutely impossible further to postpone the expenditure." The Committee continues:—It is necessary that definite action should be taken by the Council without delay, and instructions given to committees to review the position and reconsider their annual capital estimates for 1915-16, and we submit the recommendations accordingly. We desire to refer to the action taken by the Emergency Committee on August 14th, 1914, and subsequently continued by us, subject to certain modifications, as reported to the Council on 27th April, 1915, with a view to making more frequent payments to contractors than those to which they are entitled under their contracts. The object of this action was to prevent the delay of works at a time when, as the Local Government Board, in its circular of 11th March, 1915, has pointed out, "there was reason to fear that unemployment might be widespread." The same circular urges that the position is now reversed, and that "it will be necessary to economise labour to the greatest extent possible." We have accordingly given instructions for the special arrangements referred to to be discontinued, and that no further action shall be taken under the resolution of 23rd March, 1915, which was as follows:—

> That, until the conclusion of the war or during such shorter period as may be determined by the Finance Committee, in all future contracts for the execution of works of construction or manufacture with regard to which the heads of the departments concerned consider it desirable that more frequent payments than those provided for by the standing orders of the Council should be made, a provision be inserted to the effect that heads of departments shall issue certificates for weekly advances on all such contracts of less than £2,000, and for fortnightly advances on all other works contracts.

As regards sanctions to borrowings by metropolitan borough councils and loans to local authorities in London, the Committee proposes to deal with all such cases in accordance with the policy indicated in the letter from the Treasury, except those in which, as stated in the circular letter, dated 25th March, 1915, from the Local Government Board, that authority, and not the Treasury, is to decide whether the purpose for which the loan is required is one with which it is desirable to proceed at the present time. The Committee's recommendations include the following:—(a) That, in order to comply with the requirements of His Majesty's Treasury as regards the restriction of capital expenditure during the continuance of the war, the Council do take all possible steps to limit its capital expenditure. (b) That it be an instruction to all committees of the Council to take steps forthwith (i) to postpone or delay expenditure as far as possible under existing contracts and estimates already approved by the Council; and (ii) to refrain from submitting estimates for new proposals or works unless the same are for the furtherance of the war, or are of such urgent necessity that they must be undertaken immediately. (c) That it be instruction to all committees of the Council to reconsider their annual capital estimates for 1915-16, in accordance with the decisions arrived at under the foregoing resolutions (a) and (b), and to forward them, as amended, to the Finance Committee at the earliest possible date.

War Service Badges and Recruiting.—Some time ago, when Messrs. E. Bennis & Co., Ltd., of Little Hulton, were officially notified by the War Office that they had been placed upon the list of firms exempted from recruiting in consequence of being engaged on war contracts, a personal letter, as under, was addressed to each of the firm's employés impressing upon them the importance of the work on which they were engaged. Those employés who were of recruitable age were requested to give a guarantee to enlist if called upon before exemption badges could be supplied. We learn that as a result of the firm's appeal over 95 per cent. of their recruitable employés applied for badges and signed the necessary guarantee:—

GOVERNMENT CONTRACTS.

We have received official intimation from the War Office that this firm has been placed on the list of those exempted from recruiting during the period that we have armament contracts on hand.

We are in a position now to obtain war badges for those of our employés who are of recruitable age (between 18 and 38), and these we can obtain from the War Office upon each man or youth signing an application form, which can be obtained in the time office during the dinner-hour or at 5.30 p.m.

We take this opportunity of pointing out to our employés that we have large contracts in hand for mechanical stokers, coal elevators, conveyors, ash handling plants, etc., for several ammunition and powder factories that are being put up with all possible speed by the Government, quite 80 per cent. of our work now being of this character.

The present orders cover several months' work, and as we are under stringent guarantees as regards deliveries, the speed at which we turn out these orders and the quality of the work will control the placing of further War Office orders which we have at present under negotiation.

We, therefore, trust each man will realise his responsibility and assist the Government in their urgent need for war munitions by attending to his duties regularly and conscientiously, avoiding broken time, and getting through his work as speedily as possible, thus enabling us to execute the work we have undertaken within the times guaranteed.

It is our opinion that the men at home engaged in output of war munitions have as responsible and important duties to perform as have their brothers in the trenches, as it is only by their unselfish co-operation that our soldiers can be kept well supplied with ammunition, now so urgently necessary to bring this unfortunate war to a speedy and satisfactory end.

We appeal to your chivalry and patriotism, and we do not think we shall appeal in vain.

For EDWARD BENNIS & CO., LTD.,
EDWARD BENNIS, *Managing Director.*

May 5th, 1915.

Personal.—Mr. S. C. Hurry, of the Sheffield Corporation electricity staff, has been granted a commission as a second-lieutenant in the Royal Engineers' Signal Section. He has been at the front as a motor cyclist dispatch rider attached to the Cavalry Division.

Mr. Tom Sumner, electrician, of Hulton, Bolton, owes his escape from the "Lusitania" to his capabilities as a swimmer. After two years in Canada and the States as an electrician, he decided to return home recently, and booked his passage on the "Lusitania." He was on deck smoking when the first torpedo struck the ship. From the explosion, splinters flew over him. He rushed down for a lifebelt, slid down a line into the sea, and struck away just as he saw the foam of the second torpedo. He remained in the water three hours before he was picked up.

Lieut. C. L. Faunthorpe has accepted a commission in the 9th West Kent Regiment. For years he has been secretary of Blackburn Civilian Rifle Club. Lieut. Faunthorpe holds a position on the staff of Blackburn Electricity Works.

Mr. Percy Taylor, assistant electrical engineer to Darwen Corporation, has enlisted in the motor transport service. He left for Coventry on May 13th.

Mr. Jones, an electrician on the "Lusitania," was among the saved.

The "London Gazette" contains the following notice:—"Admiralty, May 12th. Royal Marines, Submarine Miners—Captain George Arthur Bruce, Tyne Electrical Engineers, Royal Engineers, Territorial Force, is granted a temporary commission as a Captain, and to remain seconded in his unit. Dated April 1st."

Roll of Honour.—Sub-Lieutenant E. B. Trimmer, of Paisley, is reported to have been wounded at the Dardanelles. Previous to the war he had charge of the electricity generating station at the Anchor Thread Mills.

Private John Francis Hobson, of Stalybridge, formerly employed at the generating station in Tame Valley, has died from wounds received in action.

It is with deep regret that we read in the "Times" that Second-Lieut. Stanley Bastian, 4th Seaforth Highlanders, the only son of Mr. C. Orme Bastian, was killed in France on May 9th. The deceased, who was 23 years of age, was, until the outbreak of war, engaged in the service of Messrs. Dick, Kerr & Co., Ltd., preparing for a commercial career. He enlisted last September, and went to the front early in November. Mr. C. O. Bastian's numerous friends in the electrical world will, we are sure, desire to join us in an expression of deep sympathy with him and Mrs. Bastian in their loss.

Private Arthur Baker, of the 8th Warwicks, who was employed at the Moseley Road depôt of the Birmingham Tramways Department up to the outbreak of war, has been wounded, and is at the Military Hospital, Kent.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Wireless Control of Public Clocks.

I have observed a paragraph under the above heading on page 624 of your issue of the 30th ult., which I recognise as an extract from a criticism by Mr. Hope-Jones, which was published in the March issue of the *Horological Journal*.

In fairness to myself, I should like to state that a complete answer to Mr. Hope-Jones's criticism appeared in the April issue of the journal in question. I would also point out that the date of issue of the *Horological Journal* in which my answer appeared was April 9th, and that my article did not appear in the ELECTRICAL REVIEW until April 16th.

It is a pity, I think, that your correspondent did not see the April issue of the *Horological Journal* before sending you the extract from the March issue, because he would have seen that Mr. Hope-Jones's condemnation was founded chiefly on an erroneous idea of the subject.

Further, the proposal to install a receiving apparatus does away with the principle of obtaining "collective" control, which is the very marrow of a well-appointed time service. A receiving apparatus could certainly be added to my scheme, but wireless control from a central point would still be required to enable a responsible individual to know that the clocks were really to time.

The last paragraph of the extract is not a literal reproduction of the statement which appeared in the original. The paragraph as it appears is misleading, and gives the impression that no licence has been necessary for receiving wireless signals. I would respectfully point out that the Postmaster-General's licence has always been necessary for receiving wireless signals, as well as for transmitting them.

Alfred E. Ball.

Leicester, *May 17th*, 1915.

[An extract from Mr. Ball's reply to Mr. Hope-Jones was published on p. 712 of our last issue; evidently our correspondent has overlooked this.—EDS. ELEC. REV.]

Photo-Printing Charges: Preferential Terms.

In your issue dated the 2nd ult. you published in your columns a letter of mine, wherein I explained that the Ilkeston Corporation had instructed Mr. S. F. James, the Town Clerk, to state a case for the opinion of counsel (Mr. W. C. Tyldesley Jones) as to whether it is legal to supply energy for photo-printing purposes at the same rates as charged for power.

Your readers will remember that in my letter I also pointed out that in reply to questions of mine, the Local Government Board wrote: "The Board are not aware of any provision in the general law upon the subject and are not aware of any decisions of the Courts upon the point." I might also add that in connection with this electricity question I resigned my position as Chairman of the Tramways and Electricity Committee.

The position now is that counsel's opinion has been received since the beginning of April, but it has not yet been made public. The Town Clerk read the opinion at the meeting of the Electricity Committee, but would not permit the writer to take a copy nor any extracts unless an undertaking were given to keep the matter strictly private, which the writer declined to do.

Surely it is not necessary in this particular case that such secrecy should be demanded.

This is not a purely local question, but a matter affecting hundreds of Corporations and scores of trades—other than photographers—throughout the country.

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Again, counsel's opinion has been taken at the expense of the ratepayers, and as no litigation is in contemplation, is it not reasonable that the ratepayers should be allowed to know the views of counsel, especially as the charges for energy to the photographers of Ilkeston have recently been advanced from power rates to lighting rates, on the plea that it is illegal to supply for photo-printing purposes at power rates?

If you or any of your readers will express their views on the point as to the necessity of keeping strictly private and confidential the opinion of counsel in this particular case I shall be pleased.

(Coun.) William Smith.

Ilkeston, *May 14th*, 1915.

[We have already pointed out that the Corporation has the right to fix any scale of charges for energy used for photo-printing that it pleases; if the scale happens to coincide with the charges for power, that does not imply that there is any connection between the two. We see no reason why the opinion of counsel should be kept secret, but that is a matter which, of course, is within the discretion of the Committee.—EDS. ELEC. REV.]

Automatic-Lift Accidents.

In reference to Mr. Broadbent's article on lift-door locks appearing in your issue of May 14th, all lift engineers will appreciate the difficulties he refers to. Undoubtedly collapsible gates are very convenient, but with the necessarily open spaces between the pickets it becomes difficult to prevent the kind of tampering with the locks referred to. We consider it is preferable to lock such gates at the centre, but we have standardised an attachment to our lock whereby the releasing mechanism is, as he suggests, placed near the top of the gate frame, to put it as far out of reach as possible. We entirely agree with Mr. Broadbent's contention that the addition of complicated apparatus which is not essential is likely in the end to be more trouble than it is worth, but we have quite a number of lifts working in which the doors or gates are actually locked before the lift moves away from a landing, and the doors remain locked while it is passing; this applies equally to automatic control as to what is known as car switch control. In such cases, if a fault developed in the lock attention would be called to it by the refusal of the lift to start.

Of course, in these days of severe competition there is bound to be a difference in the quality of the various mechanisms which go to make up a lift, but we consider that too much care cannot be given to devices such as are used for the locking of the gates, seeing how much is dependent upon their proper working. The use of a second catch for the locking lever, which we always fit, should have prevented the even remote possibility of opening the gate to which Mr. Broadbent refers, provided, of course, that the locks and other apparatus were in working order.

For **Waygood-Otis, Ltd.**

H. HARMSWORTH, *Director and Sales Manager.*

London, S.E., *May 17th*, 1915.

Trade After the War.

If you will grant me the space I would like to say that I think Mr. Edward Bergtheil's letter in your current issue very apt, with the exception that most business houses, as he suggests, do not know exactly how to begin on the overseas campaign. Provided a person or business man has seen a bit of the world outside his own native island, the problem of getting a good hold in respect of the overseas ex-Austro-German trade is fairly easy. The people, however, who might move seem mentally lethargic—in fact, one cannot kick them into animation, and I have been at it since the second week in August!

I may add, by way of explanation, that three trade associations have had my services in the past (two British and one American), and, in addition, on behalf of British and foreign firms I have either travelled or been in France, Belgium, Germany, Austria, Russia, Turkey, part of Persia, U.S.A., etc., so do not speak without my book. With this and much other experience behind me, it is clear to me that any British firm which has already an overseas connection should develop it from the overseas pitch either by suitable and more energetic salesmanship, by local publicity work (a most important item), or by a thorough investigation of the requirements in goods and terms of the overseas place or places. If a firm has no overseas depôts, well, let it get suitable agents, but first see that they are suitable, and get them to disclose their successful activities in the past, and then go by their advice as to goods, literature and service required, so that if there is to be a fault, it may be theirs, and not that of the home manufacturer.

As a very fair enthusiast, as well as a cosmopolitan business wanderer (though, unfortunately, nothing of a linguist), I will be most happy to write a lengthy and more detailed general letter on the above subject if your readers show any interest.

A. M.T.

Wimbledon, S.W., *May 17th*, 1915.

Cab Signalling.

As one who has carefully studied railway signalling methods in four countries for more than ten years, I wish to commend as strongly as possible Mr. Ogden's thoroughly sound and accurate criticisms in your current edition. From the public safety point of view, it would have been all the better for Mr. Ogden to have extended his critique to include the other grave mistakes Mr. Acfield makes concerning electrical signalling. On every point in dispute between the two writers Mr. Ogden is right and Mr. Acfield is wrong.

Track circuiting certainly was not "introduced into railway signalling in the past few years." I travelled under track-circuit protection more than fourteen years ago, and such circuits had then been in regular service for more than fourteen years. No valid reason can be given for the fact that, as to track circuiting, British steam railways are so many years behind those American railroads which operate under the same conditions. British steam railways would be signalled more economically and far more safely if antiquated mechanical devices were superseded by modern electrical apparatus.

Mr. Acfield would have been less misleading if he had paid appropriate attention to the serious objections peculiar to A.C. track circuits. It is questionable whether the undoubted advantages of this class of circuits, when considered in connection with their marked disadvantages, are sufficient to warrant the optimistic opinion he expresses. The three-wire track circuit certainly seems to offer very decided advantages over the A.C.

In asserting that the Railophone "is undoubtedly designed on right lines," Mr. Acfield is utterly wrong, as I have several times proved in the technical Press and in lectures to technical meetings in London, Birmingham, Sheffield, and elsewhere. According to published descriptions, the test (?) of this toy on the Midland Railway is a very frivolous waste of time. For instance, at least two illustrated articles (neither of them by me) in the Press show the Midland "tests" as proceeding under the conditions that two distant signals on tracks of opposite traffic are about twice the requisite viewing distance apart, that there is not a home arm on the same pole with either distant, and that there is no intervening home or distant signal for either track. Mr. Acfield knows quite well that this combination of conditions does not occur one time in a hundred. It would certainly be interesting for Mr. Acfield to inform your readers, by the aid of circuit diagrams, as to how he would extend the Midland Railophone installation so as to take care of the case of a double-track junction with a four-track route.

Every wireless cab system, whether Faradic or Hertzian, that has ever been publicly proposed is designed on lines that are decidedly wrong. The very fact that the action is "wireless"—*i.e.*, radiative—connotes a dangerous tendency inherent in such systems, but entirely absent from electrical ramp systems. The wireless impulse tries as hard to go to the wrong locomotive as it does to go to the right one; but the same is not true of the conducted—and non-radiative—impulse in the ramp systems.

Wm. H. Dammond.

Nottingham, *May 15th*, 1915.

The Engineering Industry and the War.

The statements contained in my letter of May 7th are entirely correct. I did not give weight of the human heart, but capacity and industrial performance.

J. Sutherland Warner, A.M.I.Mech.E.

London, W., *May 15th*, 1915.

Electrical Standards.—**Mr. H. M. Hobart and Mr. C. E. Skinner, who were sent to London as delegates from the American Institute of Electrical Engineers to confer with the Standards Committee of the Institution of Electrical Engineers of Great Britain in February, completed their work on March 25th, and were to make their formal report to the Standards Committee of the A.I.E.E. on May 7th. It is understood that their mission was successful, and that substantial agreement between the standards of the two countries has been reached. Sir John Snell, president of the Institution of Electrical Engineers, formally welcomed the delegates, and Dr. R. T. Glazebrook, director of the National Physical Laboratory, acted as chairman of the conferences, which were held at the home of the Institution of Civil Engineers in London. Every possible courtesy was shown to the American delegates, and there was ample evidence of the earnest desire of the British Standards Committee to arrive at a complete agreement. It is expected that through their study of both sets of rules with the British Committee the delegates will be able to make important suggestions for the clarification of the American rules. It is also thought that they will make certain recommendations for changes in the American rules in order to arrive at closer agreement than would otherwise have been possible. While there probably will still be minor differences to be settled, and while the wording of the two sets of rules will be different in many respects, it is expected that in all essential points the machinery built in accordance with either set of standards will fulfil the same specifications.**—*Electrical World.*

BUSINESS NOTES.

Consular Notes.—CHINA.—The American Consul at Peking reports that at a recent meeting of the American Association of North China a resolution was passed asking American manufacturers of machinery to follow the practice of British manufacturers in sending machinery to Chinese technical schools and universities for their use as a means of advertising American machinery and bringing it into favour with the Chinese students, who, on account of their familiarity with the machinery during their school days, will be inclined to favour its use in fields to which they may be called later in life. A committee was appointed to draw up a list of the kinds of machinery in demand, and of the institutions to which they could advantageously be presented.

HONG-KONG.—The American Consul at Hong-Kong reports: "The opportunity for the introduction of cheaper grades of electrical supplies in the Hong-Kong field growing out of the closing of the trade to German manufacturers as a result of the war, is being taken advantage of by Japanese manufacturers, and many lines of electrical goods are coming into this market from that country. There are three well-equipped factories for such goods in Japan, according to Hong-Kong importers concerned in this trade, and all of them have carried on an active campaign in behalf of their goods, which include practically all lines of ordinary electrical supplies, aside from electrical machinery and the finer grades of electrical apparatus. Prices are much lower than those for American goods answering the same purpose, though the American goods are much superior in quality. The nature of the trade is indicated by the fact that one company imports filaments for incandescent lamps from the United States and manufactures the lamps in Japan, the lamps selling here for about 15 cents gold wholesale. These lamps lack the life and the efficiency of the American or European lamp competing with them, but they attract a considerable trade and supplant, for the time being at least, the better grade lamps manufactured in Europe or the United States. The situation is similar as regards the trade in insulated wire, fuses, porcelain insulators, globes, and similar accessories. The Japanese may almost be said to control the market in some of these lines at present. A curious phase of the trade is that the Chinese importers usually prefer to buy such Japanese goods through foreign houses in Hong-Kong, thus adding a profit to the cost, but avoiding transactions with Japan direct. Prices in some of these goods from Japan run almost 50 per cent. cheaper than goods from the United States or Europe. The hope of future trade, however, lies in the poor grade of the goods and the consequent expense and trouble of early renewal. In a general way only high-grade goods will stand the climate in Hong-Kong, and the purchase of inferior grades will undoubtedly be expensive in the long run. The trade in electrical goods generally in Hong-Kong, which received special development about two years ago, continues to increase in a conservative way, in spite of the depression caused by the war. The close of hostilities and the resumption of normal trading will doubtless result in a great increase in the use of all sorts of electrical goods in this field."

Book Notices.—*How to Cook by Electricity.*—By Amy Cross and Alys Waterman. London: Lake, Sison & Brown, Ltd. Price 9d.—This little book consists of 13 pages about electric cooking, and 53 pages of tested recipes, the latter numbering 100, and covering a wide range of dishes. The talented authoresses lead off with eight good reasons for the growing popularity of cooking by electricity, and proceed to show that good oven cooking is essentially a scientific operation; to reproduce the best results with certainty, the use of the thermometer is indispensable. A thermometer, however, is useless when applied to an oven through which there is a current of air, such as a gas oven of the usual type, as the temperature cannot be correctly ascertained. With an electric oven, fitted with a thermometer, it is now possible for domestic cookery to be done on scientific lines and with the certainty of successful results. There is only one obstacle to the production of recipe books with definite directions for the times and temperatures to be employed—namely, the absence of standardisation, to which we have repeatedly drawn attention. Hence, while the writers give in their recipes the temperatures which they have proved satisfactory with most of the best ovens on the market, they suggest that the reader shall make a note of the temperatures she finds best with her own oven, and a space is left for this purpose after each recipe. Once this is done, success is certain. All the recipes given are for oven work, because the recipes found in any cookery book may be used for boiled, grilled and fried dishes. A variety of information is included regarding the use of switches, hot plates, saucepans, grills, &c., and about baking, cleaning, and using the oven without a thermometer. It is pointed out that the very best results in cooking meat are obtained by using moderate temperatures for a longer time than is customary, and that great economies can be effected by cooking with the reserve heat of the oven after shutting off the current. We feel sure that this book, tersely written in plain language and with convincing commonsense, will be heartily welcomed by electric cooks and by supply station authorities.

"*Journal* of the Institution of Electrical Engineers." Vol. LIII, No. 248. May 15th. London: E. & F. N. Spon, Ltd. Price 3s. 6d.—This issue contains a paper on "The Bombay Hydro-Electric Scheme," by Alfred Dickinson, as well as the Report of the Council for 1914-15, the annual and Benevolent Fund accounts, and the papers set in the examination for Associate Membership.

Electric Mining Regulations and Data is the title of a useful little handbook just issued, after revision, by Messrs. W. T. Glover and Co., Ltd., of Trafford Park, Manchester. It brings together in convenient form the Home Office Regulations and Memorandum, as revised in March, 1914, and a selection of data and formulæ, with a section illustrating the firm's cables and accessories designed to comply with the regulations. It is a neat and well got-up booklet, and should be welcomed by colliery engineers.

"Electric Handbook." By A. S. Richey and W. C. Greenough. London: The Hill Publishing Co. Price 17s. net.

"Single-Phase Electric Railways." By Edwin Austin. London: Constable & Co. Price 21s. net.

"The Hardening of Metals." Reprint from the *Transactions* of the Faraday Society. London: The Society. Price 7s. 6d.

War Service.—MESSRS. BERRY, SKINNER & CO. ask us to request contractors in the electrical trade requiring their switchgear to anticipate their requirements as much as possible. They say:—"It is of paramount importance, when delivery cannot be reasonably anticipated, to mention with the order if, and when, required for war service, with sufficient details so that preference may be obtained, not only with the railway companies, but, when necessary, with the suppliers of raw material and component parts. War service orders take precedence of everything, and are delivered in strict rotation as received, except by special order of the Government."

Liquidations and Dissolutions.—THE COMBINATION GAS-STEAM ENGINE SYNDICATE, LTD.—A meeting is called for June 15th, at 2 and 3, West Street, Finsbury Circus, E.C., to hear an account of the winding up from the liquidator, Mr. W. F. Conner.

VIVIAN YOUNGER & BOND, metal brokers and merchants, 7, Gracechurch Street, E.C.—Messrs. C. L. Budd, W. C. Bond and J. A. Amschel have dissolved partnership so far as Mr. J. A. Amschel is concerned.

PATENT EXPLOITATION TRUST, LTD., Finsbury House, Blomfield Street, E.C.—First meetings of creditors and contributories June 1st at Carey Street, W.C.

Large Electric Furnaces.—Referring to the article on large electric furnaces for foundry work which appeared in our last issue, Mr. G. J. Stock, of The Villas, Middleton St. George, Co. Durham, informs us that he represents the makers of the furnace in question (the Snyder Electric Furnace Co.) in this country, and has sent us some brochures describing the apparatus.

Private Arrangements.—FRANK THORNTON & CO., electrical engineers and contractors, Bridge Street, Burnley.—The creditors interested herein were called together last week when a statement of affairs was presented which showed liabilities of £921. The assets were estimated to realise £1,085, from which had to be deducted £53 for preferential claims, leaving net assets of £1,032, or a surplus of assets over liabilities of £110. The book debts (£370) were said to be practically all good, while for the purposes of the statement the stock (£649) had been taken at cost or under. Owing to the rising prices the stock was really worth 25 per cent. more. A sum of £200 had been spent in fitting up the premises, which were well adapted for the purposes of the business. It was anticipated, however, that if a realisation took place, not more than £60 would be realised for the fittings and fixtures. The present position had been brought about by shortness of working capital and by the fact that the Corporation had issued notices to the effect that no further mains or services were to be laid down. As a result, the business of the firm had been restricted. After discussing the position, it was decided that a deed of inspectorship should be executed and a committee of three of the principal creditors was also elected. The following are creditors:—

Electrical Co., Ltd.	£33	Hodgson, S., & Co.	£1
Falk, Stadelmann & Co.	28	Premier Electrical Heaters, Ltd.	11
Edison & Swan	16	Scattergood & Johnson.. ..	41
General Electric Co.	41	Gratrix, S., jun., & Bros. ..	86
Stern Electrical Co.	12	Jackson, H. A., & Co.	156
Electrical Conduits, Ltd. ..	14	Ward & Goldstone	21
Veritys, Ltd.	12	Sceando Lamp Co.	12

Trade Announcements.—MESSRS. INVETROL LIGHTING, LTD., of Invetrol Works, Bracebridge Street, Birmingham, have recently added to their business a new department for the manufacture of electric pocket batteries. It is in charge of an expert, who, we are informed, has had many years' experience in this line with leading battery manufacturers in this country. A leaflet has been issued briefly referring to the "Invetrol" "H.P." (high power) dry battery.

MESSRS. A. SEAGE & CO. announce that their works at Hammersmith will be entirely closed from 22nd to 31st inst., as they are removing to larger premises owing to increased business and lack of facilities for extensions. The new works, which have three times the floor space of the old, are at Railway Approach, Prebend Gardens, Hammersmith, W. New telephone number: "Hammersmith 613."

THE HERBERT FROOD CO., LTD., have appointed Messrs. Hitchen-Blaikie, Ltd., of 28, Cathedral Street, Manchester, sole agents for Lancashire, Yorkshire, Cheshire and North Wales, and they will carry stocks of Ferodo clutch and brake linings.

THE NORMAN ELECTRICAL AGENCIES, of 70, Great Portland Street, London, W., have been appointed sole selling agents by Messrs. Pitter's Ventilating and Engineering Co. for the sale of their multiblade desk fans.

Bankruptcy Proceedings.—J. W. Jarvis, electrician, 3, Devon Place, Edinburgh.—The estates of J. W. Jarvis were sequestrated by the Sheriff on May 11th. A meeting is called for to-day at 18, George Street, Edinburgh, to elect the trustee and commissioners. A composition may be offered at this meeting. The *Scotsman* states that the application for warrant to sequestrate the estate was made by Mr. James Scott, S.S.C., at Edinburgh Bankruptcy Court, on 11th inst., in order to obtain payment of a debt of £29. Granting of the warrant was opposed by the respondent on the grounds that he was unable to pay, that he was liable to be called up for active service at any moment, and that he expected to be able to pay his debts at the conclusion of the war. The debts represented legal fees in proceedings in which the respondent had obtained divorce from his previous wife. Within five weeks he married again, but had not paid his lawyer's bill. Sheriff-Substitute Orphoot granted the application.

G. J. T. J. Parfitt, consulting electrical engineer, 11, Priory Road, Keynsham, near Bristol, Somerset.—The adjourned public examination of this debtor was held at the Guildhall, Bristol, last week, before Mr. Registrar Wright, who declared the case closed.

T. Moore, electrical engineer, Headingley, Leeds.—Trustee (Mr. H. C. Bowling, Official Receiver, 24, Bond Street, Leeds) released March 15th, 1915.

G. E. Hepkins, electrical engineer, Dudley.—Last day for proofs for dividend, June 1st. Trustee, Mr. A. M. Fairbairn; Official Receiver, 1, Priory Street, Dudley.

Catalogues and Lists.—Mr. H. C. Jeffcoat, 18, Ranelagh Gardens, Hammersmith, London, W.—Price leaflet of "Lamlock" lampholders.

Sun Electrical Co., Ltd., 118 and 120, Charing Cross Road, London, W.C.—Three new illustrated priced leaflets for the trade. No. 266 gives particulars of the "Change-Ad" electric sign service; No. 267 deals with a new range of "Sunlite" porcelain enamelled reflectors for half-watt lamps; and No. 268 describes portable electric drills, an electric grinder for machine shops, and an electric buffer for motor garages.

Messrs. Simplex Conduits, Ltd., Garrison Lane, Birmingham.—New conduit catalogue of between 170 and 180 pages, containing those sections of the firm's catalogue dealing with conduits, conduit fittings, distribution boards, fuses, switchgear, watertight fittings, and cables. The list has been rearranged to a more convenient size; many new fittings and devices have been introduced; engineers and contractors can have copies of the publication on application.

The Steel Barrel Co., Ltd., Phœnix Wharf, Uxbridge.—Souvenir illustrated pamphlet of 32 pages, containing some information concerning the company and its works, and the steel barrels, casks, pipes, tanks, &c., which it manufactures.

General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—New price-list of Osram drawn-wire lamps, "Atmos type," 100 to 1,500 watts, and for various voltages from 50 to 255.

For Sale.—Four thousand pairs Conradty carbons for open type lamps and 2 cwt. short ends, also 150 round glass globes for street lighting. Particulars are given in our advertisement pages.

An Australian Contract.—It is reported in the newspapers that Messrs. Norton, Griffiths & Co. have entered into a £10,000,000 contract with the New South Wales Government for railways, water conservation, harbour and irrigation works, the expenditure to be spread over five years from July, 1915.

LIGHTING and POWER NOTES.

Accrington.—Year's Working.—A loss of £3,073 is recorded on the year's working of the electricity undertaking. The gross revenue amounted to £28,802, a decrease of £1,124, and the gross expenditure to £21,613, an increase of £3,634. Some 6,340,000 units were sold, as compared with 5,850,000 units in the previous year, the power supply, excluding tramways, accounting for 4,113,000 units.

Arbroath.—Street Lighting.—The T.C.'s agreement for street lighting with the Arbroath Electric Light and Power Co. expires in August next, and the company is to be asked on what terms it will renew the agreement.

Ashton-under-Lyne. — Subject to permission being obtained from Hurst U.D.C., the T.C. has acceded to an application from Messrs. Jas. Howe, Ltd., for a supply of current to Mount Mill, Hurst.

Australia.—According to the *Sydney Daily Telegraph* a large up-to-date electrical plant is being installed at Mount Pleasant Colliery, on the South Coast, at an estimated cost of £35,000. The installation will consist of three alternators coupled to steam engines, each capable of developing 440 kw. at 6,600 volts. The power will be applied to various purposes connected with the working of the colliery, about three miles distant. The main heading will be illuminated with electricity, and a new haulage house at the pit mouth will contain one of the largest endless rope haulage sets in the Southern hemisphere, capable of hauling 1,200 tons of coal per day.

Aylesbury.—Public Lighting, &c.—The U.D.C. has agreed to have the Market Square lit by electricity, at a cost of £170; to give a day supply of 50 h.p. to the Dominion Dairy Co., at 1½d. per unit, and to purchase a 20-ton barge of fuel oil, at £3 13s. 6d. per ton.

Barnes.—Year's Working.—The result of the past year's working of the electricity undertaking shows a net profit of £1,765, as against £3,214 in the previous year. This decrease is attributed solely to the war. In view of the restricted lighting order the Electricity Committee has reduced the street lighting account by £57 in respect of the past quarter.

Barnsley.—Proposed Extensions.—The Electricity Committee recommends that the Council approve of the scheme for extensions to the electricity works, at a cost of £21,850, and that application be made to the L.G.B. for borrowing powers. The Committee also recommends that the Corporation scale of grants be not applicable to men joining the Army Service Corps.

Blackpool.—Price Increase.—From the commencement of the September quarter all electricity tariffs are to be advanced 10 per cent.

Boston.—Prov. Order.—The B. of T. has granted to Mr. Robert Arthur Smith, of Westminster, a prov. order for E.L. within the borough, and at Skirbeck, Skirbeck Quarter, Fishtoft, Freeston, Wyberton, Frampton, and Kirton, in the area of the R.D.C. The T.C. is to have the option of purchasing the undertaking at the end of stated periods, but the order is not to come into force until the end of the war.

The L.G.B. has agreed to sanction a loan for a refuse destructor, but it is not to be taken up during the duration of the war.

Bradford.—The profit of the electricity department for the past year has been £12,000, and £7,500 is proposed as a contribution to the relief of the rates.

Carshalton.—Refuse Destructor.—The U.D.C. has referred to the Sanitary Committee the question of approaching the Beddington and Wallington U.D.C.'s, with a view to the provision of a refuse destructor for use for the three parishes.

Croydon.—The borough electrical engineer reports that in considering necessary extensions for next winter's supply he would, in the ordinary course, have recommended works involving an outlay of £3,500, but, owing to shortage of labour and L.G.B. restrictions, he advises only works of imperative necessity—viz., extensions of cables, at a cost of £498. The recommendations have been adopted by the Council.

Dover. — Correction. — We regret to find that the second paragraph appearing under "Dover" heading last week found its way there in error. The information related to another borough, not to Dover.

East Sussex.—Asylum Lighting.—The C.C. has, in consequence of enhanced prices of materials and difficulty of delivery, decided not to have the electrical storage battery at the Asylum renewed, but to install a smaller complete engine and dynamo set. The new scheme, it is anticipated, will cost less than the £900 allowed for the renewal of the battery, and will reduce the running and maintenance cost.

Gravesend.—The T.C. has sanctioned three extensions of mains, one to supply current to the factory of the Associated Portland Cement Manufacturers, and another to Wombwell Hall.

Heywood.—A loss of £927 was sustained on the working of the electricity undertaking for the year ended March 31st, 1915.

Owing to the high prices of fuel the charges for electricity are to be increased 10 per cent. from May 1st, 1915.

Hove.—The T.C. has decided to extend the mains to Portland Road Schools, now used as a military hospital, at a cost of about £387, provided the War Office bears the cost of the extension.

India.—The new electric power scheme for Darjeeling, which was formulated by the late engineer to the municipality, by which current was to be supplied to the two cantonments of Lebong and Jellapahar and outlying places, is being held in abeyance pending a report from Mr. Stoneybridge, whose services have been engaged by the municipality for the consideration of a larger scheme. The present intention is to establish three or more power stations on the Mahanady River at Phulbazar, and on the Tista, near Geljhora, four miles from the Tista Bridge. It is believed that with such a scheme in operation the needs of the tea gardens throughout the district right down to Dim Dimma, and those on the Nepal border as far down as Nuxalbarie, including the town of Siliguri, would be amply met.—*Indiaman.*

Keighley.—Prov. Order.—The B. of T. has granted a prov. order, for inclusion in a confirmation Bill, authorising the Corporation to supply electricity to places in Oakworth, Oxenhope, and Keighley rural district, except East and West Morton.

Leigh.—Loan Sanction.—In reference to the paragraph in our last issue concerning the delay to Government contracts suffered by the Anchor Cable Co., and the steps taken to deal with the matter, it is now announced that the L.G.B. has sanctioned, without inquiry, the borrowing of the money necessary for the extensions at the electricity works.

London.—The Shoreditch B.C. is recommended to make application to the L.C.C. for sanction to a loan of £1,500 for house services, mains, &c.

Bermondsey.—The Electricity Committee has further considered the question of altering the stokers of the three Howden boilers at the generating station, and has received an additional scheme submitted by Babcock & Wilcox, Ltd., for providing a chain-grate stoker to each boiler, the cost of which would be £400 per boiler, plus £130 for the driving gear and motor for all three, making a total of £1,330, or a saving of £428 as compared with the previous scheme. The Committee reports that it has adopted this scheme in preference to the more expensive one.

L.C.C.—The conference, mentioned in our last issue as being convened by the L.C.C. to discuss the question of London's electricity supply, was held on Wednesday, practically every borough council and supply company being represented.

Manchester.—Barton Scheme Inquiry.—The electricity department of the Corporation is hopeful that it will be able to convince the Treasury of the pressing need for an extension of its generating plant by the commencement forthwith of the erection of the new generating station at Barton, at a cost, approximately, of £768,000. As a result of representations made by the Electricity Committee, the L.G.B. has decided to hold a public inquiry to-day.

Mansfield Woodhouse.—The U.D.C. has consented to Mansfield T.C. erecting overhead lines in the district for the transmission of current to Clipstone Military Camp.

Market Weighton.—E.L. Scheme.—The Pocklington R.D.C. has given consent for the E.L. scheme submitted by Mr. C. H. Best, of Bradford, to be commenced. Mr. Best informed the Council that the scheme will be proceeded with if certain financial support is secured to assist local efforts.

Swansea.—Street Lighting, &c.—The Lighting Committee of the T.C. is considering a proposal for lighting a portion of Neath Road with 300-c.p. incandescent lamps attached to each alternate tramway pole and fed by an overhead wire, at a cost of £1,500. The electrical engineer has reported as to the running of a new feeder from the electricity works to Morriston. The consideration of the matter has been deferred. The Committee has approved the suggestion of a local firm (which intends to sell electric cars), that the department should supply current for charging electric cars at low rates, and has decided to charge all batteries on the restricted hour rate of 1½d. per unit, with a minimum sum of £2 per service per annum.

Slaithwaite.—The Electricity Committee has deferred consideration of the specifications of the proposed electric lighting plant.

TRAMWAY and RAILWAY NOTES.

Barnes. — Electrically-Propelled Dust Vans.—An offer of Edison Accumulators, Ltd., owing to the fact that L.G.B. sanction to the loan could not be obtained, to accept payment in four annual amounts of £1,060 each for the vans, proposed to be purchased by the Council, has been declined.

Bolton.—Various improvements in the track have now been completed in parts of the Corporation's tramway system. The suggestion of extending the system from Deane to Westhoughton appears to have been shelved indefinitely.

Bradford.—Employes at the Front.—The number of Corporation employés who have enlisted for war service is 701, equal to about 10 per cent., and of these the largest number has been contributed by the tramway department, which has sent 215 men, 7 of whom had been killed and 23 wounded, so far as is known at present. The total number of Corporation employés known to have been killed is 14, wounded 44, and prisoners in Germany about half a dozen.

The approximate profit for the year in the Corporation tramway department was £27,500, as compared with £29,500 in the previous year, and it is proposed to put £25,000 to relief of rates.

Clifton (Lancs.).—An agitation has again been set on foot for securing the linking up of the South Lancashire Tramway Co.'s system at Clifton with the Salford Corporation's lines at Pendlebury. The Kearsley District Council has appointed a deputation to represent its interests in the matter.

Continental.—Belgium.—According to Dutch reports, an Allied airman recently dropped a bomb on an electric car at Ostend, killing 24 soldiers.

Croydon.—The B.C. has adopted the following resolutions passed at a conference of managers of the tramway undertakings within the metropolitan area held on May 7th :—(1) That tramways revenue cannot be improved by increasing fares generally; (2) That joint action should be taken by the tramway authorities in the metropolitan area, to obtain more equitable treatment for tramways in respect of rates and the upkeep of roads; (3) That powers should be obtained to jointly run omnibus services. There are 119 Croydon tramway employés now with the Colours, or 30 per cent. The London strike was reported to have caused a material reduction of tramway receipts in Croydon.

East Ham.—The Tramways Committee proposes to negotiate with the Barking District Council for the purchase of two of the latter's tramcars.

Heywood.—Year's Working.—For the year ended March 31st last, there was a loss of £1,042 on the tramways undertaking. This is attributed to decreased earnings owing to the war, and to heavy expenditure on repairs to track.

Ipswich.—Female Labour.—The T.C. has arranged to release a number of tramway conductors to be employed in the manufacture of munitions of war, and to employ in their stead females over the age of 21 years, who will be paid 22s. per week of 60 hours, and be provided with overalls and hats.

London.—L.C.C. Strike.—On Friday last a general strike of L.C.C. tramway employés commenced, and has, at the time of writing, spread to the Metropolitan Electric Tramways in North London and adjoining areas. The men apparently want an immediate increase of 15 per cent. in wages; a re-arrangement of the working hours; and claim that their requests to enlist for the war, and be reinstated afterwards, have been refused. The Highways Committee points out that, under the Conciliation Board's scheme, the men agreed not to reopen the question of wages until June 26th next; that 79·81 per cent. of the men receive the maximum rate of 6s. 6d. a day, and only 12·28 per cent. receive as little as 5s. or 5s. 3d. a day, these men having been engaged to replace enlisted men, and receiving in addition a bonus. It is admitted that at four periods of the year the duties are spread over 14 or 15 hours a day, but the minimum spread-over is under 9 hours, and the average daily hours of work are 8 hours 24 minutes. About 2,000 employés have enlisted, and the Committee states that as many as 500 have withdrawn applications to enlist which had already been conceded.

London Electric Railway Companies' Facilities Bill.—The Parliamentary Committee of the L.C.C. recommends that, in the opinion of the Council, the proposals contained in the London Electric Railway Companies' Facilities Bill, 1915, should not become law unless accompanied by adequate safeguards for the interests of the Council and of the travelling public of London, and that a petition be presented against the Bill.

Newcastle.—Bonus Arbitration.—The award in connection with the war bonus dispute on the Newcastle tramway system was made known last week. The Corporation had agreed to a bonus of 2s. 6d. per week to those earning less than 30s. a week; 1s. 6d. to those earning 30s. or more; and 1s. to youths up to 18 years old. The Tramways Committee as an alternative more agreeable to the men suggested 2s. 6d. a week to householders; 1s. 6d. to single men without dependents; and 1s. to youths. The latter proposal, which was rejected by the Council, has been adopted in its entirety by the Arbitration Committee.

Paisley.—Female Conductors.—Arrangements have been made by the Paisley and District Tramways Co., for the employment of women car conductors, fully 100 of the male workers having left the service for the Army. Lady checkers have meantime been appointed.

Salford.—The Tramways Committee has agreed to refer the bonus question to arbitration. The first body of women conductors were expected to begin their training this week. The Committee has decided to reduce the facilities for half fares for children to those not above 12 years, instead of 14 years as formerly, and this is expected to give increased revenue to the extent of £4,000 per annum, given normal traffic.

Southampton.—Year's Working. — Traffic receipts on the Corporation Tramways for the year ended March 31st last show an increase of £369, as compared with the previous 12 months. The number of passengers carried shows an increase of 103,491; 159,691 more miles were run than in 1914 and the receipts per car-mile show a decrease of ·930d. There has been an increase of 35,871 units in the current consumed, costing an additional £224.

South Staffordshire.—A meeting of drivers and conductors employed by the B.E.T. Co. in this area was held last week, when it was decided to ask for an increase of ½d. per hour in wages to cover the increased cost of living. Failing this being granted, it was also decided to cease work on Saturday. A resolution was likewise passed protesting against the employment of women in connection with the services.

Venezuela. — Railway Electrification. — At the meeting in London last week of the La Guaira Harbour Corporation, Ltd., it was stated that the conversion to electric traction of the Macuto and Coast Line Railway has been completed and had proved a great success.

TELEGRAPH and TELEPHONE NOTES.

Illicit Wireless.—A resident of Malvern, Victoria, named W. A. Bleeck, has been charged with being in the unlawful possession of wireless apparatus; he was an employé of the Commonwealth postal department. A technical breach of the War Precautions Act was proved, and a small fine imposed.

New Atlantic Cable.—A statement has appeared in the German Press to the effect that a new cable is about to be laid between the Scandinavian States and the United States, which will not as heretofore pass *via* England. The preliminary work has been carried out, and the estimated cost will amount to 40,000,000 marks. Thanks to this new cable, says the journal, Germany will be able to telegraph to the United States without the necessity of making use of wireless, and, consequently, will be able to send secret messages.

Norway.—The number of telegrams transmitted during the year 1913-14 amounted to 3,870,000, or 73,000 more than during the period 1912-13. Telephone messages over long distances numbered 6,270,000, an increase of 688,000 as compared with the previous period. There are now nearly three messages per capita, which probably represents a record. The total revenue from the telegraph and telephone lines amounted to £738,200, as compared with £404,300, and the working expenses amounted to £319,000, as compared with £294,900 during 1912-13. The surplus was £12,000, as against £11,000 for the previous period. The total capital spent on telegraph and telephone lines amounted to nearly 2 million pounds sterling, and the sum added during the last period was about £207,000.

Pacific Cable.—Last week armed raiders made an attack upon the Pacific cable station at Bamfield Bay, on the west coast of Vancouver Island. Several men landed in a boat and made an attempt to cut the cable which connects Canada with Australia. The sentry on duty fired at them and turned the guard out; the guard rushed to the beach, but the men by that time had jumped into their launch, and were making off. Shots were fired after them. No damage was done to the cable.

South Africa.—The British forces under General Botha last week occupied Windhuk, the capital of German South-West Africa. The wireless station, a very powerful one, able to communicate with the stations in Togoland, and at Tabora, in German East Africa, was found practically intact.

Week-End Letter Telegrams.—The arrangement introduced on January 1st for sending week-end letter telegrams at approximately one-fourth of the charges for ordinary telegrams between soldiers, sailors and nurses serving with His Majesty's Forces in the United Kingdom, France and Belgium and members of the general public in British possessions, has now been extended to the Forces serving in German South-West Africa. The special telegrams can be accepted for Lüderitzbucht at 9d. per word, and for Swakopmund at 10d. per work. The transmission thence to members of the Forces who may have advanced inland will be undertaken by the military authorities.

Wireless on Board Ship.—The Board of Trade has decided to take the necessary steps to postpone the coming into operation of the Merchant Shipping (Convention) Act, 1914, until January 1st, 1916. By this Act all British ships carrying 50 or more persons, and also foreign ships entering British ports, are required to be provided with a wireless telegraph installation.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Melbourne.—June 15th. City Council. Four mechanically-fired boilers, one turbine-driven boiler-feed pump, two fuel economisers, circulating water pumps. City Electrical Engineer. Specifications from Messrs. McIlwraith, McEacharn & Co., Ltd., London, E.C.

June 30th. Victorian Railway Commissioners. One 13-in. centre lathe for turning or grinding commutators for traction armatures; one 9-kw. motor-generator and battery-charging accessories; four electric motors.*

Sydney.—July 12th. Metropolitan Board of Water Supply and Sewerage. Two steam turbines and condensers at Ryde pumping station, for the Chatswood pumping plant. Secretary, 341, Pitt Street, Sydney.

July 19th. Council. Maximum-demand indicators. Specification (10s. 6d.) from Electric Light Department.

July 19th. Municipal Council. One or two 12,000-kw. turbo-alternators (Contract No. 363).* A copy of the specification can be obtained from the City Electrical Engineer, Sydney.

July 19th. Steel towers for 33,000-volt transmission line. Specification (10s. 6d.) at E.L. Department, Town Hall.

July 21st. N.S.W. Government Railways and Tramways Department. One 250-k.v.a. turbo-generator.*

Adelaide.—June 30th.*—Deputy P.M.G. 120 miles of outside distributing wire; 123 miles of insulated copper wire.

July 7th.*—27,000 jointing sleeves and 55,000 copper binders.

Specifications for the items marked * can be seen at the B. of T. Commercial Intelligence Branch in London.

Bury St. Edmunds.—May 27th. Corporation. Twelve months' supply of coal for the Electricity Department. Forms of tender from Mr. S. E. Day, Borough Electrical Engineer.

Chesterfield.—May 25th. Coal (about 8,000 tons of slack) for a year from September 1st, for the Corporation electricity works. Mr. R. L. Acland, Borough Electrical Engineer, Chatsworth Road.

Dublin.—May 25th. Corporation. Underfed stoker. See "Official Notices" May 14th.

Dundee.—June 4th. Corporation Electricity Department. Reinforced-concrete floors and jointless flooring, required for the extension to Carolina Port generating station.

Edinburgh.—June 21st. Two 5,000-kw. turbo-alternators and condensing plant, for Portobello supply station. See "Official Notices" to-day.

Finchley.—May 31st. U.D.C. Wiring, for light, 100 workmen's dwellings. See "Official Notices" May 7th.

Grangemouth.—The burgh invites tenders for supply of stores, including electric lamps. Mr. David A. Donald, Burgh Engineer.

Leeds.—May 26th. Corporation. Steam, feed and water pipes. See "Official Notices" May 7th.

London.—L.C.C.—The Highways Committee recommends that tenders be invited from selected firms for the provision of switchgear in connection with the temporary supply of power for the working of the Council's tramways, and that the chairman and the vice-chairman of the Committee be severally authorised during the Whitsuntide recess to accept the most favourable.

June 4th. Installation, 260 wiring points, 345 lights, also electric bells, at the County Secondary School, South Hackney. See "Official Notices" to-day.

Manchester.—June 2nd. Corporation. Coal-unloading crane, conveying plants, &c. See "Official Notices" May 7th.

Middlesbrough.—5,000 tons of rough small steam coal, for the Cleveland and Durham Electric Power Co., Ltd. Particulars from the Secretary, Hinton's Buildings.

Portsmouth.—June 1st. Corporation. 100 tons of steel girder tram rails, five tons of steel fishplates, one ton of fishplates, three tons of 5-ft. wrought-iron tie-bars. See "Official Notices" May 14th.

May 26th. Electric lighting, &c., at Girls' Hostel, for the Education Committee. See "Official Notices" May 14th.

Rangoon.—August 11th. Installation of a system of fire-alarms, for the municipality. Specification (10s.) from Messrs. Ogilvy, Gillanders & Co., 67, Cornhill, E.C.

Sheffield.—May 28th. Two natural draught cooling towers complete. For the Electric Supply Department. See "Official Notices" May 7th.

Tasmania.—Launceston.—July 26th. Sub-station equipment. Section I, Converter machine, switchgear, &c.; Section II, Underground feeder cable. Specification (21s.) from the City Electrical Engineer, Town Hall.

Wigan.—May 29th. Corporation. H.T., three-core, paper and lead-covered, armoured feeder cable, transformer and switchgear. See "Official Notices" May 14th.

CLOSED.

Australia.—The Melbourne, Brunswick and Coburg Tramways Trust has accepted the tender of Messrs. Duncan and Fraser, of Adelaide, for 12 cars at £486 per car. Tenders let for the overhead equipment and material, sub-stations, trucks, wheels, axles and car equipment amount to over £53,000. The system is expected to be running early in 1916.

East Ham.—The tender of Messrs. Dick, Kerr & Co., Ltd., to re-equip one of the tramcars with a 40-h.p. motor, new controllers, &c, for £275, has been recommended to the T.C. for acceptance.

Edinburgh.—The Corporation E.L. Committee recommends the acceptance of the tender of the Stirling Boiler Co., Renfrew, at £32,000 in connection with the extension works at Portobello.

Hendon.—The following tenders have been received by the Guardians for installing electric light at the institution:—

Hendon Electric Supply Co.	(including lamps and shades) (accepted)	£350
Strand Electric Co.	(do. do. do.)	421
C. C. Pudney & Co.	(not including lamps)	310
Napier-Kimber, Ltd.	(not including lamps and shades)	212
H. J. Galliers	(do. do. do.)	334
A. F. Goodwin & Co.	(including lamps and shades)	469
Electra, Ltd.	(do. do. do.)	370
C. H. Cathcart & Co.	(not including lamps and shades)	475

The tender of the Hendon Electric Supply Co., provided for a 10-h.p. motor, which was larger than required for the institution. The firm were, however, prepared to supply a 7½-h.p. motor and allow £4, and a further £6 discount on lamps, &c., which would reduce their tender to £340. The company's amended tender has been accepted.

Ilford.—The District Council has accepted the tender of Edison Accumulators, Ltd., at £1,240, for the supply of an electrical coal wagon of 4 tons' capacity, fitted with battery and automatic tipping gear. According to the report of the electrical engineer, the tenders received included three makes of battery, viz., lead, lead (ironclad) and Edison. The lowest cost of carrying 12,000 tons of coal annually was quoted by the Cedes Electric Traction, Ltd., whose vehicle is fitted with a lead battery. The next lowest was that of the Edison Accumulators, which was only £6 above that of the Cedes Co. The engineer was of opinion that the best proposition was that of Edison Accumulators, Ltd., because, although the first cost was rather higher than some of the other quotations, the running cost was less, and at the end of 10 years, when the capital had been wiped out, the vehicle should still be fit for several years' further service.

Ipswich.—The T.C. has accepted the tender of Messrs. Heenan & Froude for extensions to the refuse destructor plant. The total cost will be £5,200.

London.—The Metropolitan Asylums Board has accepted the tender of the London and Rugby Engineering Co., at £32, for an electric motor for driving workshop tools at the North-Western Hospital; also the tender of Messrs. Lund Bros., & Co., at £28, for accumulator-charging plant at the South-Eastern Station.

BERMONDSEY.—The Electricity Committee recommends the acceptance of the tender of Messrs. Babcock & Wilcox, Ltd., at £1,330, for three chain grate stokers.

L.C.C.—The Education Committee recommends that the chairman, vice-chairman and deputy-chairman of the Council, the chairman and vice-chairman of the Education Committee, or the chairman and vice-chairman of the Education (Buildings Sub-) Committee may open during the Whitsuntide recess tenders for installing electric light in the County Secondary School, South Hackney.

Maidstone.—For the E.L. installation at the Agricultural Hall the following tenders were received:—

W. Cogger	(accepted)	£27
Drake & Fletcher		39
W. T. Burrows		40
Haynes Bros.		46
Oswald Jones & Co.		49

Malvern.—The U.D.C. has accepted the tender of the Electrical Apparatus Co., Ltd., for a year's supply of meters.

The Gas and Electricity Committee has accepted the following tenders for coal:—South Wales and C. C. Coal Co., Ltd., 2,500 tons; Mr. W. Edwards, 1,500 tons; Wilson, Carter & Pearson, 2,000 tons.

Meter Contracts.—Messrs. Chamberlain & Hookham, Ltd., have received the following contracts for the supply of meters for the coming year:—Battersea, Dundee and Swansea; also from Southwark, for prepayment meters.

Messrs. Ferranti, Ltd., have recently obtained contracts for C.C. meters for one year from the following electric supply authorities:—Hornsey, Battersea, Pontypridd, Edinburgh, and Stockton-on-Tees. Also from York Corporation for prepayment meters for a year.

The Southwark Borough Council has placed a contract for D.C. meters up to and including 25 amperes, and the Worthing Corporation has placed a renewal contract for the sole supply of 3-ampere meters during 12 months, with the Electrical Apparatus Co., Ltd.

The County Borough of East Ham has placed a contract with the British Thomson-Houston Co., Ltd., of Coventry, for twelve months' supply of their direct-current meters.

Pontypridd.—The U.D.C. has accepted the tender of Messrs. Siemens Bros. Dynamo Works, Ltd., for "Wotan" and tantalum lamps for twelve months.

Southend-on-Sea.—The following tenders have been recommended to the T.C. for acceptance:—

John Browne.—Five dozen steel tram tires, £20 per ton.
F. Carrick & Sons.—Overhead travelling crane, £301.

Tottenham.—The District Council has been recommended to accept the tender of Messrs. Keene & Co., at £90 10s., for the supply of an electric motor.

FORTHCOMING EVENTS.

Association of Supervising Electricians.—Tuesday, May 25th. At St. Bride's Institute, Bride Lane, E.C. Annual General Meeting.

Institution of Electrical Engineers.—Thursday, May 27th. At 8 p.m. At Victoria Embankment, W.C. Annual General Meeting.

Physical Society of London.—Friday, May 28th. At 8 p.m. At King's College, Strand. Papers on "Numerical Relations Between Electronic and Atomic Constants," by Dr. H. S. Allen; "A Method of Calculating the Absorption Coefficients of Homogeneous X-Radiation," by Mr. H. Moore; "Two Experiments Illustrating Novel Properties of the Electron Currents from Hot Metals," by Prof. O. W. Richardson, F.R.S.; "High Permeability in Iron," by Prof. E. Wilson.

Royal Institution of Great Britain.—Friday, May 28th. At 9 a.m. At Albemarle Street, W. Paper on "Engineering Problems of Mesopotamia and Euphrates Valley," by Sir J. Jackson.

NOTES.

Trans-Oceanic Telegraphy.—Some time ago it was announced in Germany, on good authority, that the German cable companies would by no means pass over the payment of dividends for the past year, notwithstanding the protracted interruption of traffic through British action. Apart from the fact that business had been in course of further development in the first seven months in 1914, the German cable companies are in enjoyment of Imperial subsidies which were fixed in such a manner as not only to afford security for the loans issued by them, but also to ensure a certain return to the ordinary shareholders. At the same time it has to be borne in mind that the working expenses, particularly in regard to the cost of acquiring new business, have been reduced by the compulsory interruption of traffic. This statement has now been confirmed in one case, seeing that the German Atlantic Telegraph Co. proposes to pay a dividend of 6 per cent. as compared with 7½ per cent. in 1913.

A further matter of current interest relates to wireless telegraphy across the Atlantic. It will be recollected that in September of 1912 the High-Frequency Machine Co., of Berlin, concluded an agreement with an international undertaking—the Compagnie Universelle de Télégraphie et Téléphonie, of Paris—whereby the latter was to take over the stations built or then in course of construction by the former, at Eilvese, in Germany, and Tuckerton, New Jersey. The explanation of the proposed transfer lies in the fact that the Germans assumed at the time that their aims would be more likely to obtain recognition, especially in the United States, through an international than through a purely German enterprise. At any rate, the German company was to receive, partly in cash and partly in shares, the sum of £100,000 from the Paris company for the use of the Goldschmidt high-frequency machine patents outside of Germany, and £80,000 for the station at Tuckerton, but it is uncertain how much was to be paid for the Eilvese station, if it was really intended that this should be transferred to the control of the international company—a control which would probably have been merely a nominal one from the Teutonic point of view. But the occurrence of war naturally brought about a change in relationship. When hostilities first took place the transmission of wireless messages between the Tuckerton station—which had been established prior to the Germans securing a licence or concession from the Government of the United States—and the Eilvese station had passed beyond the experimental stage, and an application was then submitted to the American authorities asking for a concession.

The agreement between the two companies had not been completed on the outbreak of the war, but the Paris company is now seeking to secure its fulfilment in the United States, through proceedings which have been instituted in the courts at New Jersey, although the Tuckerton station, which has been placed under the control of the United States Government for the duration of the war, would be of no use unless a corresponding station were erected in France. The German company contests the competency of the New Jersey courts, contending that the plaintiff company must proceed before the German courts. It is also submitted, according to a New York correspondent of a German newspaper, that actions for differences in regard to property between subjects of nations now engaged in war cannot hold good, and that if the American courts settled them they would represent a breach of neutrality. If, however, the Paris company were placed in possession of the Tuckerton station, the Eilvese station would not remain in communication with it, and thus the service to Germany, which is now maintained only through the American control, would be, it is held, seriously injured. It is specially by means of this station, apart from the station of lesser power at Sayville, that communication is maintained with Germany, which would otherwise be entirely cut off from the United States. On the other hand, it is urged that the surrender of the Tuckerton station to the Paris company would also have the result of rendering matters inconvenient for the American Government. The correspondent concludes, therefore, that even if the New Jersey courts should decide in favour of the plaintiff company it is probably out of the question that the latter would gain possession of the station, and that there are so many legal measures available against such a judgment that the war would have to last a very long time before these resources were exhausted.

Denmark.—A firm of engineers in Odense desires to secure the representation of United Kingdom manufacturers of electrical goods, including transformers, insulators (especially H.T.), insulating materials (fibre, &c.), watertight fittings, tumbler and ironclad switches, ammeters and voltmeters. Apply to the Commercial Intelligence Branch of the Board of Trade, London, E.C., for the name and address.

Patents and Alien Enemies.—Application has been made to the Board of Trade by Messrs. Gilbert Gilkes & Co., Ltd., to avoid or suspend Patent No. 22,565/12, granted to Honold, for runners for Francis turbines. The Board has granted a licence to Messrs. W. T. Henley's Telegraph Works Co., Ltd., in respect of Patent No. 5,198/08, granted to Miele.

The King at Parsons's Turbine Works.—In the course of his visit on Wednesday to Tyneside engineering and shipbuilding works, his Majesty the King was conducted through Messrs. Parsons's turbine works by Sir Chas. Parsons.

Market Quotations.—The British Aluminium Co. quote the following prices for aluminium:—Ingots, £95 per ton; wire £125 per ton; sheet, £125 per ton.

The British Association.—At the annual meeting, which, as already announced, takes place at Manchester, from Tuesday, September 7th, to Saturday, September 11th, Prof. A. Schuster will deliver the presidential address in the Free Trade Hall, and the evening discourses will also be delivered there. A conversazione will be held on Wednesday evening, September 8th, in the Manchester Institute of Technology. It is hoped that visits may be paid to some of the principal works, mills and warehouses of Manchester and Salford. The reception room will be in the Whitworth Hall of the University. The sectional meetings will take place in the buildings of the University or its immediate neighbourhood.

Section A.—Mathematical and Physical Science.—Chairman, Sir F. W. Dyson, F.R.S.

Section B.—Chemistry.—Chairman, Prof. H. B. Baker, F.R.S.

Section G.—Engineering.—Chairman, Dr. H. S. Hele-Shaw, F.R.S.

Sheffield Electrical Social Union.—On Monday evening, the 17th inst., the members of this Union held a successful gathering at Stevenson's Restaurant, Castle Street, Sheffield. Tea was served at 6.30, and was followed by a thoroughly enjoyable Smoking Concert. Well encored songs were given by Messrs. Farrant, Giles, Burdett, Robinson, Chatfield, Royce and Hemmington, whilst Mr. Clarke gave banjo solos. Mr. Lumb was in the chair.

Canada.—A Vancouver firm desires to be placed in communication with United Kingdom manufacturers of dry batteries and bulbs for flashlights, torches, &c., torch cases, flashlight cases, and nitrogen-filled half-watt lamps. An agent in Montreal, who has had considerable experience in the purchasing of hardware and electrical fixtures and general tramway supplies, desires to secure the agencies of United Kingdom manufacturers of these goods. Applications should first be addressed to the C.I. Branch of the Board of Trade in London.

Fires Due to Air Raids.—The British Fire Prevention Committee, which is always on the alert for an opportunity to carry on its beneficent work, has issued a circular (memorandum No. 18) pointing out that the fire brigades will necessarily devote their attention first to protecting Government offices and military stores and works, so that the owners of private property should organise measures for their own protection. Suggestions are therefore given as to the proper steps to be taken in anticipation of raids by air-craft, and technical advice in special cases is offered free of charge. Inquiries should be addressed to the Gen. Hon. Secretary, Mr. Ellis Marsland, 8, Waterloo Place, Pall Mall, S.W.

British Industries Fair.—According to all reports the British Industries Fair, held at Islington, has been an unqualified success. A dinner was to be held on Wednesday night at the Hotel Cecil, Lord Southwark, President of the London Chamber of Commerce, presiding, and with Mr. Runciman, President of the Board of Trade, as principal guest, for the purpose of marking exhibitors' appreciation of the services of the Board of Trade. The *Times*, in referring to the large amount of business that has been done as the result of new industrial enterprises embarked upon since the outbreak of war, says:—"In the glass and pottery sections orders amounting to some £40,000 have been placed for glass bulbs for electric lamps, in which Germany has hitherto held a lead." There seems to be a strong desire for the Government to organise the Fair annually, and there can be little doubt that, as we suggested last week, if such a course be adopted, quite a big event of very far-reaching importance, requiring much larger premises, may be expected.

L.C.C. Employés.—It was reported at Tuesday's meeting of the L.C.C. that a petition had been received from some of the light and power attendants employed in the rolling-stock section of the tramway department asking that their rate of pay (8d. an hour) be increased by 1½d. an hour; that light and power attendants who had done wiremen's work in the past, and were now engaged on electrical work, might be regarded as traction wiremen for depôt work only; and that an opportunity might be given for such traction wiremen to be promoted to the grade of general wiremen as vacancies occurred. As the Highways Committee was not prepared to recommend the Council to accede to these requests, the men asked that their application be referred to the appropriate conciliation board, and it is proposed that this course be agreed to.

Thefts of Electric Lamps.—At the Central Criminal Court, before the Recorder, Alfred Sears, 43, traveller, was convicted of stealing electric lamps from the office of Mr. Farloe, 50, Gresham Street. It was stated that the prisoner had made a practice of visiting various offices and, representing that he had authority to inspect electric lamps, had availed himself of the opportunity of substituting old lamps for new ones, which he took away and sold. He was detected by the housekeeper at 50, Gresham Street and given into custody. He said, on arrest, "Do forgive me, I have a wife and family." Detective Dyer, City police, proved that accused had been twice previously convicted of stealing electric lamps, and there were numerous complaints of losses from City offices. Prisoner was sentenced to 12 months' hard labour.

Inquiry.—Makers of Reflex carbons for kinematograph purposes are asked for.

Institution and Lecture Notes.—Electrical Association of Australia.—In his address as president of the Victorian Section, on March 31st, Mr. W. H. Alabaster detailed the progress that had been made in the use of electricity in Melbourne during the past 10 years, and indicated the possibilities for future advances. In 1914 the Melbourne undertakings had an output of 36 million units; he anticipated that in five years this would be increased to 100 millions, in addition to 129 millions for the suburban railways, making a total of 229 million units for Melbourne and the suburbs. Mr. Alabaster also discussed the use of electricity for cooking, which he had practised for a long period in his home; he considered that some system of hire-purchase was necessary to induce consumers to install the apparatus.

Junior Institution of Engineers.—Mr. C. H. Woodfield, speaking recently on the subject of cranes, said that in the comparison of steam or hydraulic cranes with electric cranes, there was not a single feature in favour of the former two as regarded cost of installation, durability, economy in working and upkeep, or facility of control. An important feature in favour of the electric crane was the ever-ready reserve power up to 100 per cent. momentarily and 50 per cent. for a longer period than was required for crane work. As regarded upkeep, the wear and tear of electric motors was not half as much as for the steam crane.

Society of Engineers (Incorporated).—On the 11th inst. Mr. A. H. Barker, Wh.Sc., read a paper on "Heating and Ventilation." He said that the legitimate function of the engineer was to produce and control specified movements of air and other effects, while it should be the duty of the physiologist and hygienist to specify what were healthy and comfortable conditions. In connection with heating, the expression "temperature of a room" was generally understood to mean the reading of a thermometer suspended in the room, but this reading did not necessarily indicate the temperature of the surrounding air, or form a reliable guide to the feelings of the occupants of the room. The air temperature, the radiant temperature, the quantity of convected heat and the quantity of radiant heat must all be determined, but first the relation between the thermometer reading, the air temperature and the radiant temperature must be determined. The freshness of air in a building depended on keeping the air temperature relatively low and the radiant temperature high. The chemical composition of the air had, within wide limits, no effect on the human organism, whereas the temperature and humidity were very important. The paper described experiments made at University College and the apparatus used in connection with them, and discussed briefly some problems which it was sought to solve experimentally.

Electric Lift Fatality.—At an inquest at Manchester recently, touching the death of Harold Vincent Burgess (27), who received fatal injuries through being pinned in the well of a lift for 40 minutes, it was stated that he pushed a truck into the cage of the lift and in endeavouring to reach over to press the lever he slipped. The lift was set in motion and, his legs hanging beyond the floor of the cage, he was trapped between the wall and the cage on the second floor. A verdict of "Accidental death" was returned, and the Coroner, commenting on the fact that he had conducted a similar inquiry a day or two before, said it seemed to him that there should be some protection for the starting handles of lifts.

Educational.—University of Bristol.—In order to provide additional residential accommodation for students, the University has recently rented houses which will form a temporary college for men students, and will be ready for use in a few weeks.

German Business Methods.—At the Sales Managers' Association in London last night, Mr. J. H. Vickery, LL.B., a Canadian, who for fourteen years practised International Law in Berlin, delivered an address on "German Business Methods as seen by a Canadian Resident in Berlin."

Appointments Vacant.—Junior assistant electrical engineers, over 19 (15s.), for Newcastle-on-Tyne Electric Supply Co.; junior engineer (temporarily), for Walsall Mains and Sales Departments (£2); charge engineer (38s.), for duration of war, for Wakefield Corporation. Particulars are given in our advertisement pages.

Copper.—The gradual increase in price of standard copper does not, so far, appear to have stimulated production in any marked degree. Messrs. H. R. Merton & Co.'s tabulated statistics for May 15th show an increase in European visible supplies of 1,065 tons for the fortnight, and an increase in English supplies of 2,915 tons. In detailed supplies, European arrivals from North America are low as compared with the pre-war average. Supplies from Spain and Portugal to England and France are well up, and considerably above the pre-war average, and those from unclassified "other countries" are also high. Chile shipments show the unusually low figure of 842 tons for the fortnight, which may be due to the large quantity received last month from this source. Australian shipments are maintained at the same figure as for the last three months, which is still about a quarter less than the pre-war average, though better than the earlier months of the war. Total deliveries are low compared with those for March, but promise to considerably exceed April deliveries. In view of unusual consumption it is remarkable that the price does not more rapidly increase, and that visible supplies increase at all.

(*Continued on page* 733.)

ELECTRICITY SUPPLY AT KARACHI, INDIA.

Karachi, the most westerly of the four great ports of commerce in the Indian Empire, has, during recent years, been growing in importance at a phenomenal rate, and it is not impossible that it will loom largely in the map of the world that is now being remade, as the Government have intimated that it will be the Indian terminus of the proposed great Trans-Persian Trunk Railway connecting Europe with India through Moscow and Baku, and surveys of the first part of the route from Karachi have already been made.

It is the chief outlet for the products of the Punjaub (wheat, oilseed, cotton, &c.), and has considerable commerce with Afghanistan and Baluchistan.

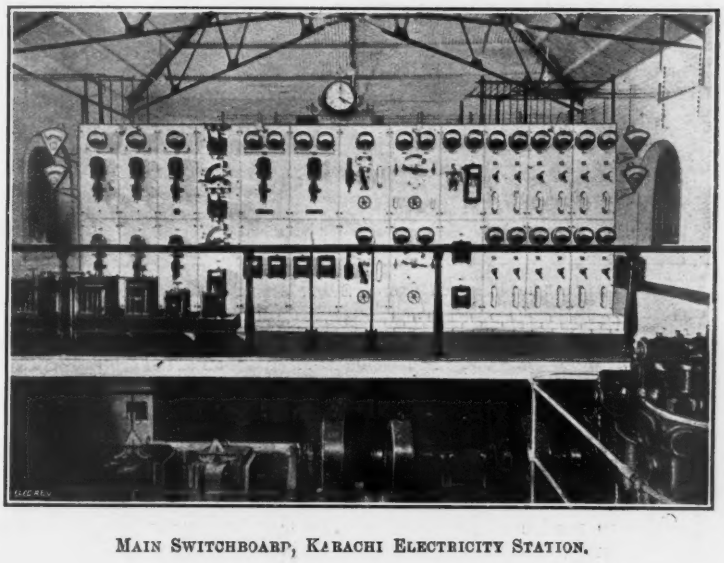
The total trade of the port has increased by leaps and bounds, and in 1912 it reached the phenomenal figure of £40,725,000, while in 1914, despite the war, it was still £34,000,000.

The population between the census of 1901 and that of 1911 jumped from 115,402 to 159,270—an increase of 38 per cent.

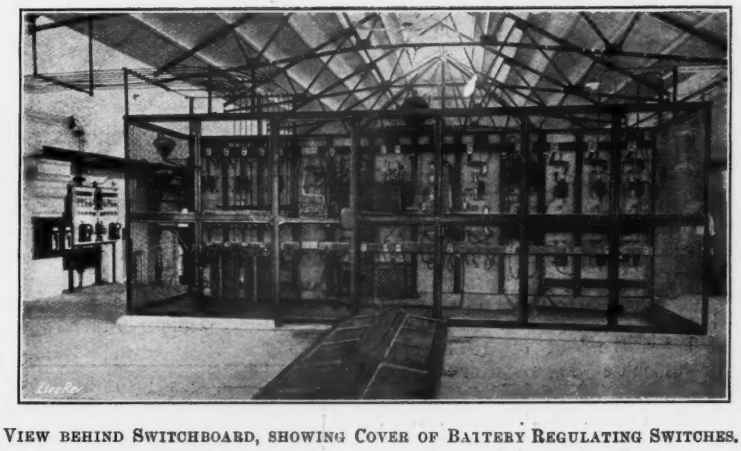
The commerce of the port overshadows everything else, but there naturally follow in its wake industries established there that pertain to commerce, among which are extensive local flour mills, ironworks, printing presses, soda water factories, &c., with land and facilities all ready for the considerable increase in their number that is sure to result from the general trend of events and the importance of the district.

Some years ago the Port Authority installed their own electrical undertaking, but up to a month or two ago there was no public supply of electrical energy or of gas. A few years ago, however, the Hon. Mr. M. de P. Webb, C.I.E., of the well-known firm of Messrs. Forbes, Forbes, Campbell and Co., Ltd., took the preliminary steps to introduce a scheme for the supply of electrical energy, and this has now been achieved.

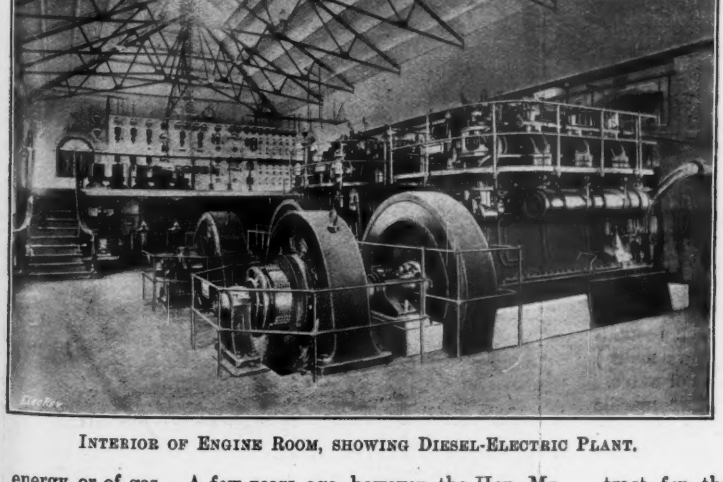
It will be observed that Karachi is one of various prosperous communities in the East which have preferred to rely on electricity rather than on gas for their development and well-being.



Main Switchboard, Karachi Electricity Station.



View behind Switchboard, showing Cover of Battery Regulating Switches.



Interior of Engine Room, showing Diesel-Electric Plant.

Messrs. Crompton and Co., Ltd., the well-known electrical contractors, came on the scene at an early stage, and with their assistance, the Hon. Mr. M. de P. Webb investigated the prospects of a public electric supply undertaking, as a result of which Messrs. Forbes, Forbes, Campbell & Co., Ltd., decided to apply, under the Indian Electricity Act of 1910, for a Government Licence to supply electrical energy in Karachi.

This was granted in due course, and in 1912 the licensees retained Messrs. Handcock & Dykes, of Westminster, as their consulting engineers.

After some negotiations a very suitable site was selected in the Elander Road, with ample space for extensions, and with access to the railway.

As a result of full consideration it was decided to install a direct-current Diesel-driven plant, with a three-wire system of distribution throughout the district, and early in 1913 the Karachi Electric Supply Corporation, Ltd., was brought into existence, for the purpose of taking over the rights conveyed by the licence and of putting them into effect. A contract for the complete equipment of the power house and distributors was entered into with Messrs. Crompton, and shortly after that a start was made on the foundations.

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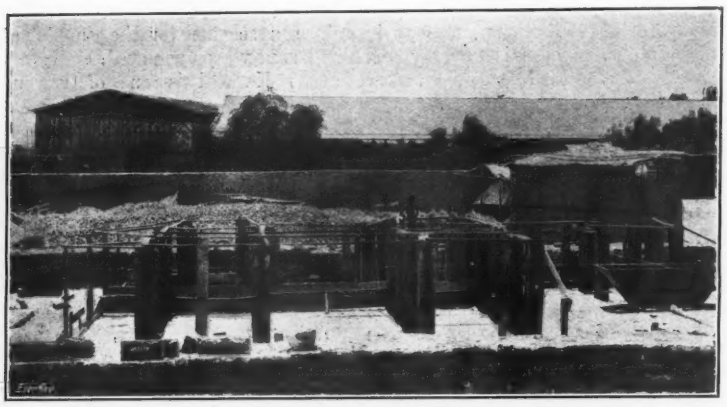
These in themselves were a matter of considerable magnitude in proportion to the works, as, owing to the nature of the soil, it was necessary to excavate to some considerable depth, the work being also impeded by tidal waters and land floods. All difficulties of this nature were gradually overcome, and a substantial armoured-concrete bed put in position to receive the machinery.



Putting in Foundations of Station Buildings, Karachi.

The outbreak of the war caused considerable delay in the works, as the licensees, from patriotic motives, decided to transfer part of the staff to the wiring of troopships, while at a somewhat later stage the consulting engineers' representative, and also some of the contractors' representatives on the spot, joined His Majesty's Forces. The work originally was to have been completed by the end of 1914, and, despite delays and other difficulties due to current events, on February 1st, 1915, the completed station was formally opened by the Commissioner in Sind, R. P. Barrow, Esq., I.C.S., in the presence of a large gathering of the principal inhabitants.

Where East meets West: Native Group outside the Generating Station.

In an important city like Karachi it was necessary to give very careful consideration to the relative merits of overhead and underground distribution, and the engineers ultimately decided in favour of the former. The area of supply is roughly triangular, with the station situated centrally in a three-mile base line.

The first section of the generating plant, as at present installed, consists of two 240-B.H.P. and one 100-B.H.P. Diesel engines, supplied by Messrs. Mirrlees, Bickerton and Day, and direct-coupled to Crompton 440-580-volt dynamos.

The cooling of the circulating water was a problem calling for careful consideration, and the engineers finally decided on using Messrs. Heenan & Froude's coolers, two of which have been provided, either being capable of dealing with the circulating water required at full load. The coolers are fixed in a cooler house opening out of the engine room, a 10,000-gallon water storage tank (fed from the town mains) being fixed above to provide the necessary storage of water.

The main switchboard, consisting of 14 white marble panels, including three generator, two battery, two booster, two balancer, one summation, one earth and three feeder panels, complete with moving-coil measuring instruments and switchgear, is mounted above the battery room, being thus raised some 7 ft. above the engine room floor.

The battery consists of 276 Tudor cells, having a capacity of 653 ampere-hours at the 10 hours' discharge rate.

The pressure of supply is 220 volts on either side of a three-wire system (440 volts across the outers), but at full load the station voltage will rise to about 512 volts, to compensate for the drop in the feeders.

This necessitates battery regulating switches having a large number of contacts; these switches are of the horizontal pattern, and are fixed in the floor above the battery room, behind the main switchboard, being operated by levers similar to railway signal levers, fixed in front of the board.

There are two automatic balancers, each capable of dealing with an out-of-balance current of 75 amperes, and three motor-driven boosters, each capable of a continuous output of 150 amperes at 0—115 volts.

It was thought wise to start, in the first place, with direct current, as tending in the earlier stages to bring the undertaking more quickly to a remunerative stage; but it is not impossible that as the area and the scope of the operations are extended, a mixed system will be adopted to meet the probably large demand for energy for power purposes that is sure to grow up.

The whole of the overhead work has been carried out in strict accordance with the regulations of the Indian Government, and is most substantial throughout, with a considerable margin in the strength of the poles for additions as the undertaking develops.

The weight of copper installed with the first section is 35 tons.

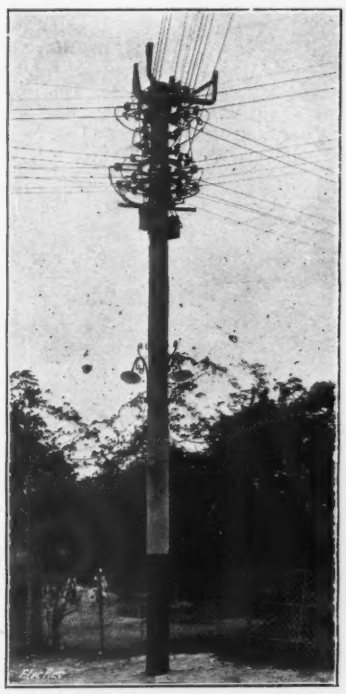
Heenan Cooler at Generating Station.

A considerable number of consumers have already been connected, and the licensees have made arrangements by which all consumers who so wish, may have their wiring work carried out at a most reasonable price and in a first-class manner, under their supervision.

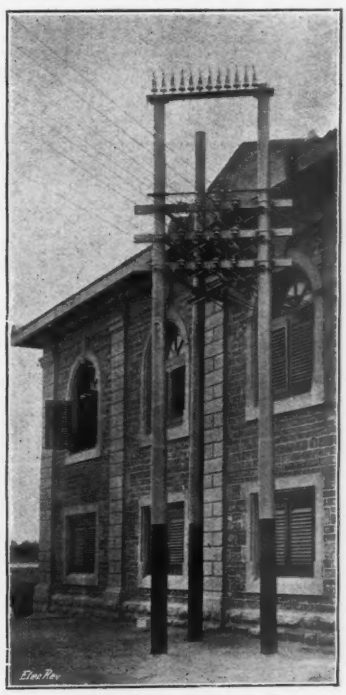
Messrs. Crompton & Co.'s contract has been carried out under the supervision of their representative, Mr. T. F. Raven; the consulting engineers' representative during the earlier stages was Mr. F. N. Merzies, until he joined His Majesty's Forces, and Mr. H. Frazer Nash, his successor, has now become the resident engineer.

Considerable extensions of the works are already in hand, due to a very important contract entered into with the Municipality for public lighting, which, in the first instance, will embrace some 500 lamps.

Not the least interesting circumstance in connection with the undertaking is the fact that of the nine directors, seven are Indian gentlemen, who have given influential support to the project.



Feeder Pole: 36 wires.



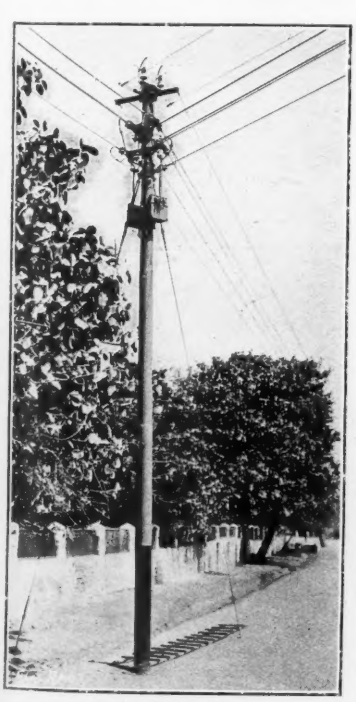
Station Terminal Pole.

Overhead Distribution, Karachi (see page 729).

THE WOOD GREEN ELECTRICITY UNDERTAKING.

The supply of electrical energy in Wood Green, which commenced last Christmas, is being given by the Tottenham District Light, Heat & Power Co.—formerly known as the Tottenham and Edmonton Gas Light and Coke Co.—to whom the statutory powers were transferred in 1913.

The area of supply under the order embraces the whole of the urban district, comprising 1,625 acres with a population of 50,000 inhabitants.



Link Pole. Pole Line, showing Lighting Bracket.

Overhead Distribution, Karachi (see page 729).

The generating station is situated in Ringslade Road at the rear of the company's local offices and in close proximity to the depôt of the Metropolitan Tramways.

Town gas supplied from the Tottenham works of the company is delivered through a 12-in. main into a holder on the site, which has a diameter of 40 ft., and performs the dual rôle of providing gas storage and maintaining it at the required pressure at the engine valves. A special meter of 20,000 cb. ft. per hour capacity has been provided to measure the gas used.

The generating station is a steel and brick structure with three bays, the centre one forming the engine house; the ground floor of one of the side bays provides accommodation for the switchboard and electrical control gear, and for a fitters' workshop, above which the battery room has been constructed. Water-cooling plant and silencers occupy the other bay, the water-softening plant, storage tank, offices and stores being situated on the upper floor.

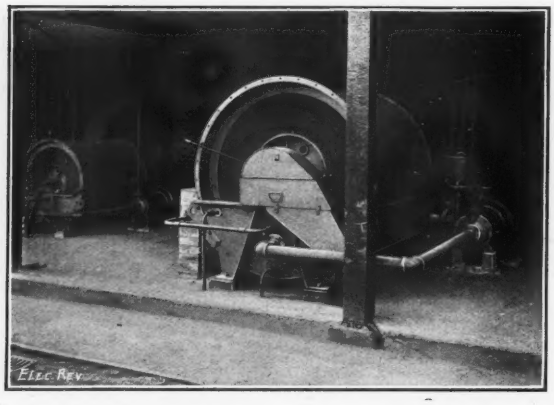
Two sets of generating plant have already been erected, one of 100 kw. and the other of 200 kw. capacity, and space is available for two additional sets of still larger capacity, as the demand develops. There is also a battery of 200-kw. capacity on a one hour discharge.

The gas engines are the modern high-speed vertical type, built by Messrs. Hindley and Sons, one of 170 and the other of 340 b.h.p., running at 450 r.p.m. and 350 r.p.m. respectively. Both have five cylinders, and are equipped with forced automatic lubricating arrangements and double magneto ignition.

By means of the multiple cylinders and high speed of rotation, the working parts of the engine are kept comparatively small. As the principal working parts are enclosed and lubricated under pressure, the wear and tear are reduced to a minimum. The engines can be started up and put on full load in less than a minute. There is no noticeable vibration—specially designed foundations having been provided to ensure this—and the silencing of the exhaust has been made almost ideally perfect, the multiple cylinders and high speed being a distinct aid to this attainment.

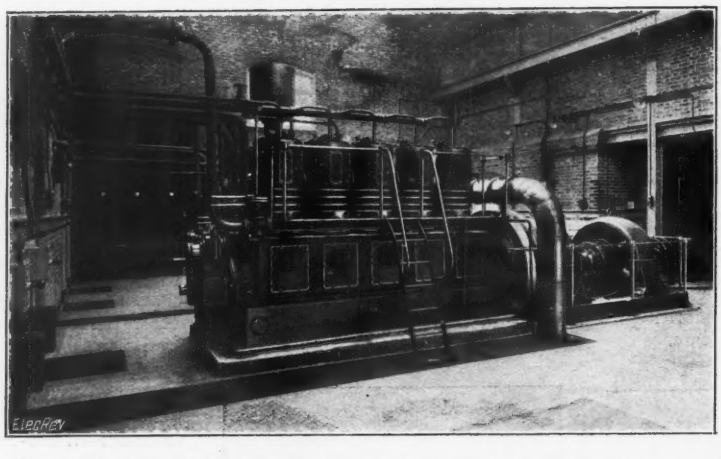
Compressed air is used for starting the engines, and is taken from a battery of four receivers, which are charged by a motor-driven air compressor.

The circulating water for the engine cooling is supplied by gravity from a tank of 1,600 gallons capacity, situated



HEENAN COOLERS AT WOOD GREEN GENERATING STATION.

on the first floor over the cooling plant. By means of interlocking gear between the compressed-air valves and the water valves, the starting up of the engines without first turning on the water is rendered impossible. The water flows into two Heenan rotary water coolers, capable of dealing with 4,000 and 2,000 gallons of water per hour respectively, and is returned to the storage tanks by means of electrically driven centrifugal pumps. All the water used is first treated by a Boby water-softening plant of 300 gallons capacity.



HINDLEY HIGH SPEED GAS ENGINES OPERATING ON TOWN GAS.

The engines are directly coupled to tandem direct-current dynamos of the Electric Construction Co.'s make, these being multipolar shunt-wound machines fitted with interpoles. The armatures of each set have been made strictly interchangeable, even to the provision of a coupling outside the outboard bearing. The machines are designed to generate current at any voltage from 250 to 280.

The battery, which was supplied by the Chloride Electrical Storage Co., consists of 270 Plantide cells. The whole of the regulating cells range along one side of the room, and the copper rod connections are carried on insulators on the wall to the centre, where they are carried down through insulating tubes in the floor to the regulating switches which are immediately below.

For charging the battery there is a double-ended E.C.C. booster in the engine room; the two boosting dynamos each have a capacity of 10 KW., and are driven by a 58-B.H.P. 500-volt motor, running at a speed of 1,200 R.P.M., the starting panel being fixed close at hand.

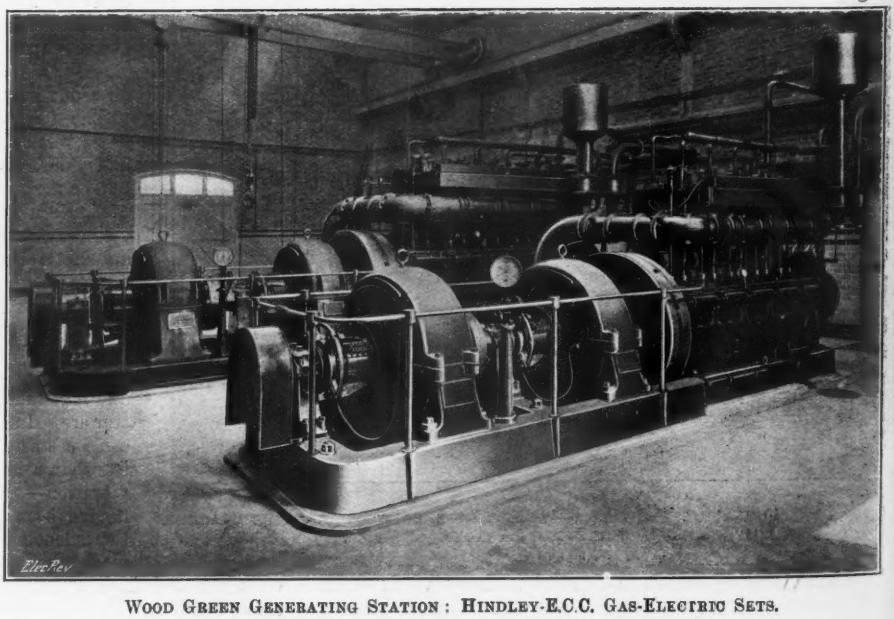
The switchboard, which also came from the Electric Construction Co., consists of two generator, one battery and booster, one integrating watt-hour meter, and three feeder panels, all of black enamelled slate.

The panels are divided horizontally at the centre by an enamelled slate shield, the top half being devoted entirely to the positive side of the system and the lower half to the negative. All the circuits are protected by automatic cut-outs, and, where suitable, time lag attachments are provided. The whole of the instruments are of the Cirscale type manufactured by the Record Electrical Co. The regulating gear has been kept entirely separate from the board; the resistances are placed in a cellar into which all the cable connections from the generators and boosters come and also the feeder cables. Immediately above the resistances, the control pillars, eight in number, including two for the battery regulating switches, are mounted on the engine room floor. An earth panel with an Everett-Edgcumbe disk recording ammeter, short-circuiting relay and overload breaker, is fixed on the wall at the back of the board.

A 10-ton Morris hand-operated travelling crane has been installed in the engine room.

Under the contract the consumption of gas by the generating sets working at ordinary full load, with gas of 500 net B.TH.U. per cb. ft. at a normal temperature and barometric pressure, is guaranteed not to exceed, for the 200-KW. set, 30·75 cb. ft., and for the 100-KW. set, 31·35 cb. ft. per unit generated, as registered by watt-hour meters; trials of the plant give warrant to the view that the guaranteed results will be excelled.

The supply is on the three-wire system at 240-480 volts.



WOOD GREEN GENERATING STATION: HINDLEY-E.C.C. GAS-ELECTRIC SETS.

Under the Wood Green Electric Lighting Order the streets scheduled for the compulsory mains were limited to High

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Road and Myddleton Road, but the company has inaugurated the supply with a comprehensive system of distributing mains throughout the principal streets of the district.

All the cables are of the three-core type, paper-insulated, lead-covered and steel armoured, and were supplied by the Western Electric Co. There are three feeding centres where the feeder mains serve the distributors, one situated near the Town Hall, one in the High Road adjacent to Noel Park Station, and the other in the Alexandra Park district; at these centres feeder pillars have been erected, and similar pillars in other situations provide an easy means for dividing up the network of distributing mains into suitable sections. All the pillars, service boxes and consumers' fuse-boxes have been made by Messrs. Lucy & Co., while the service and station meters are of the Chamberlain & Hookham type.

The capital expenditure on the scheme, including Parliamentary costs, land, generating station and mains, amounts to about £30,000.

Responsibility for the preparation of the scheme is shared by Mr. A. E. Broadberry, manager of the Tottenham District Light, Heat and Power Co., and Messrs. May and Hawes, consulting engineers. The duties of directing and supervising the constructional operations have been performed by Mr. J. Fisher, assistant manager of the company, and Mr. L. W. Ballard, chief assistant to the consulting engineers, supervised the constructional work, &c.

NOTES.

(*Continued from page 728.*)

Gas Engine Tests.—In a paper read before the Institution of Mechanical Engineers on Friday last by Prof. A. H. Gibson and Mr. W. J. Walker, of University College, Dundee, tests on an experimental gas engine made by the National Gas Engine Co., Ltd., are described. Town gas was used, having a lower calorific value of 520 B.TH.U. per cb. ft.

It was found that the mechanical efficiency of the engine, which had a maximum output of 36 B H.P. at 250 R.P M, increased with increasing load, the highest value recorded with the richest mixture and at the lowest speed (150 B.P.M) being 88 per cent. At the normal speed (200 R.P.M.) has the efficiency 85 per cent. The mechanical efficiency diminished as the ratio air : gas increased from 7 : 1 to 11 : 1, and diminished as the speed increased; it was independent of the ratio of compression.

The thermal efficiency, referred to the B H.P., increased with the load, and attained a maximum with an air : gas ratio of 8 : 1; it diminished as the speed increased, and increased with the compression ratio.

Special provision was made for separating and measuring the exhaust losses, which, at full load, lay between the limits 33·6 per cent. and 42·5 per cent. The former value corresponded to a weak mixture, high compression and low speed, and the latter to a rich mixture, low compression ratio and high speed.

Electric Vehicle Committee.—At the last meeting of this Committee held on May 11th, Mr. A. E. Collins, the city engineer of Norwich, took his seat as the representative of the Institution of Municipal and County Engineers; Mr. A. de Turckheim took his seat as representative, *pro. tem.*, of the Tramways and Light Railways Association, and Mr. G. F. Heath, of Heath's Garage, Ltd., as the representative of garage interests.

The Committee considered and passed the draft for the Committee's annual report and accounts, to be incorporated in the annual report of the I.M.E.A., and the Secretary submitted the draft of the report to be submitted for discussion at the annual meeting of the I.M.E.A. on June 17th, entitled "The Uses of the Electric Vehicle in Municipal Service."

The arrangements were discussed for the proposed parade of electric vehicles on June 17th, and the time was provisionally fixed for 5 p.m. If permission is obtained the parade will be held on the Embankment.

As the result of the circular letter sent to electric supply undertakings, a number of them have purchased publicity material; the Secretary, however, reported that he had received several letters which indicated apathy on the part of some undertakings in regard to the electric vehicle business.

The Technical Sub-Committee have now completed the preparation of the report upon "Methods of Charging and Charging Equipments," which is to be circulated to members of Committee. The Committee has decided to ask the Accumulator Section of the B.E.A.M.A. to consider the desirability of bringing about standardisation in regard to (1):—The clearance for the accumulation of sludge between the lower edge of the plates and the bottom of the cell container; (2) the size of the filler plug-hole and a design of plug for same; (3) the distance between the top of the lip of the plug hole and the top edges of the plates, so that one gauge may always be used in a garage for fixing the proper level of the electrolyte, measuring from the top edge of the filler hole lip; and (4) details of connectors between cells and method of connecting these to the plate terminals.

Lead Scarcity in Russia.—The scarcity of lead in Russia is one of the problems of the national electrical industry. Deposits of lead ore having been discovered in the district of Murman, it is announced that a furnace has been erected for smelting the ore in the Ulsen factory, Archangel. The lessees of the deposits are Stephanovitch and Ostrem.

Petrograd Electric Station: Oil Fuel Difficulties.—The introduction of petroleum as fuel at the Petrograd electric tramway power station has led to some irregularities in the supply of current. On May 5th a damaged valve in the tank whence the boilers received their supply resulted in these remaining without fuel. The petroleum had to be fed in by other means; but the result was a reduced supply of electricity and a temporary stoppage of the tramway service. Such is likely to recur at times till all the boilers are equipped for burning liquid fuel. Meantime fresh supplies of coal (the scarcity of which was the cause of the conversion of the boiler furnaces for liquid fuel) are being received.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Aylesbury U.D.C. has re-appointed Mr. W. A. Turnbull as resident engineer at the electricity works, on the same terms as his previous engagement. He has acted as clerk of works during the erection of the station.

Mr. H. Woolgar, fourth engineer at the Fulham B.C. electricity works, has been temporarily appointed to the position of shift engineer, at a salary of £3 per week, during the absence of Mr. A. Abdern on military service, and Mr. L. Float, junior engineer, has been appointed fourth engineer, at a salary of £2 2s. per week.

Mr. C. Handley, shift engineer at the Scottish Central Electric Power Co.'s generating station, Bonnybridge, Falkirk, has resigned his position in order to take up the duties of shift engineer at the Corporation electricity works, Motherwell.

General.—With reference to the notice that appeared in our last issue respecting Mr. Harry W. Nimmo's movements, we learn by this week's mail that the Government of Burmah has, on his being relieved of the duties of Electrical Inspector, retained his services for an indefinite period, for the purpose of getting out detailed estimates of a proposed electricity supply scheme.

Mr. Howard Eady, district telephone manager at Jersey for 15 years, has been appointed manager for the Exeter area. Prior to going to Jersey in 1900 he was at Bournemouth.

Prof. S. P. Thompson, F.R.S., delivered the Swarthmore Lecture at the Central Hall, Westminster, on Tuesday last, taking as his subject "The Quest for Truth."

Councillor Jackson has been elected chairman of the Swinton and Pendlebury Electricity Committee.

Mr. C. C. T. Eastgate has been appointed Electrical Inspector to the Government of the Punjab, Lahore. Mr. J. H. Cardew, electrical engineer, North-Western Railway, Lahore, has resigned the Government service, and Mr. D. A. Petruse, foreman electrician, has been placed in charge of the office of electrical engineer of that railway.—*Indian Engineering.*

Mr. J. Scrivener has resigned his position as director and manager of Messrs. Krupka & Jacoby, Ltd., having been appointed to control the sales organisation of the "Z" Electric Lamp Manufacturing Co., Ltd., Southfields, S.W. Mr. Scrivener's late co-directors have given him a gold watch as a mark of their personal esteem, and the staff have presented him with a suit case.

Mr. Walter F. Bradshaw has been appointed manager of Reuter's Telegram Co., Ltd., in place of the late Baron de Reuter.

Sir Edgar Speyer, consequent upon "charges of disloyalty and suggestions of treachery" that have been made against him in the Press and elsewhere, has asked Mr. Asquith to accept his resignation as a Privy Councillor and to revoke his baronetcy. He has also resigned his seat on the board of the Underground Electric Railways Co. of London, Ltd., and Lord George Hamilton, the deputy-chairman, has been appointed chairman in his stead.

Obituary.—Mr. G. Maurice.—There is, unhappily, no room for doubt that Mr. G. Maurice, of the General Electric Co., Ltd., must be numbered amongst the victims of the *Lusitania* disaster. A correspondent, who was in intimate touch with him, sends us the following personal appreciation:—"As one who was in close companionship with him for 18 years, I feel that some note of appreciation may be welcomed by his many friends in the electrical world. Many qualities go to the making of a man if his success is to be assured. Mr. Maurice most surely exhibited in his business career the possession of all those qualities that may be considered essential ones. Insight to direct him what to do, foresight to tell him how to attain, courage to enable him to overcome—these three virtues were his chief characteristics, and the successful application of them to his daily life may be said to be the foundation on which his career was built. His was a full life; a life largely devoted to the business to which he was attached, and with which his interests were bound up. His career was a singularly successful one; whatever came under his control prospered. His capacity for work was enormous, his ability insured success, his handling of large affairs was conducted with

cool judgment and skill, and a firm belief in the righteousness of his action invariably carried him through, no matter how fierce the opposition against him. No man can go through life without meeting opposition in the course of his business career, and Mr. Maurice had many opportunities of crossing swords in the pursuit of his aims; but he was a good fighter who invariably earned the respect of his opponents. In estimating his personal expression as revealed to those who came in contact with him, I think the word "respect" most closely expresses the influence he exerted over others, over the staff, his competitors, in fact over all with whom he had business relations. The many warm expressions of regret received from business men all over the world show in how much respect he was held, and how deeply his loss is deplored. It is doubly sad since the many years of faithful, strenuous, and hard endeavour had but recently won him a seat on the Board of the G.E.C., in which position his characteristic ability would have found still greater fields in which to operate. Mr. Maurice leaves a wife and one child, a daughter." We may add our own personal appreciation of the late Mr. Maurice, as the result of editorial relations with him extending over many years, perhaps more particularly in connection with matters concerning the G.E.C. electric light fittings department, and latterly the heating and cooking department. There are few men in the electrical industry with whom it has been so genuine a pleasure to converse as with him; his was the perfection of courtesy—a quality which editors, who not infrequently come across something totally different, know how to value when they meet it.

MR. H. F. FRIEDERICHS.—At the funeral of the late Mr. Friederichs, Corporation electrical engineer at West Hartlepool, there were indications of the affection and esteem in which he was held. Among the chief mourners were Mr. J. E. Dawson, chief assistant, Mr. C. W. Thompson (electrical engineer, Saltburn), the Mayor and many members of the Corporation, Mr. J. J. Smith (electrical engineer, Stockton), and the staff of the West Hartlepool electricity department. The body was borne to its last resting place in Stranton Cemetery by some of the oldest workmen. Among the wreaths was one from Sir John Snell, and one from the workmen and staff of the electricity works bore the inscription: "A tribute to our noble and unselfish master." A member of the staff, in writing to us, describes Mr. Friederichs as "one of Nature's gentlemen," and makes mention of his genial, kind and unassuming manner, which secured for him the passionate attachment and devotion of the whole of his staff.

MR. BRODRICK CLOETE, a director of Messrs. Vickers, Ltd., was among those lost in the *Lusitania*.

NEW COMPANY REGISTERED.

Simplex Sleeper Syndicate, Ltd. (140,294).—This company was registered on May 11th, with a capital of £3,450 in 2,850 pref. shares of £1 each and 12,000 ord. shares of 1s. each, to take over certain patents or rights for an invention relating to railway or tramway sleepers and the electrical installation of track rails, to adopt an agreement with C. P. Sandberg, O. F. A. Sandberg, and N. P. P. Sandberg, to carry on the business of manufacturers, installers, and users of, agents for and dealers in railway or tramway sleepers and devices for the electrical installation of track rails and similar appliances, and mechanical and engineering devices for use upon railways and tramways, etc. The subscribers (with one pref. share each) are: T. Jowett, 43, Savoy Court, Strand, W.C., civil engineer; P. Wheeler, Central Buildings, Westminster, S.W., civil engineer. Private company. The number of directors is not to be less than three or more than eight; the first are C. P. Sandberg (chairman), O. F. A. Sandberg, N. P. P. Sandberg, A. Spencer, T. Jowett, and P. Wheeler. Qualification, £5. Remuneration, £50 each per annum. Registered office: Palace Chambers, Bridge Street, Westminster.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Pernambuco Tramways and Power Co., Ltd.—Issue on April 20th, 1915, of £25,000 debentures, part of a series of which particulars have already been filed.

Phœnix Electric Heating Co. (1914), Ltd.—Mortgage on moneys payable under certain Admiralty contracts, dated May 10th, 1915, to secure all moneys due or to become due from the company to Parr's Bank, Ltd., 126, High Holborn, W.C., not exceeding £200.

Torquay Tramways Co., Ltd.—A memorandum of satisfaction to the extent of £800 on May 7th, 1915, of charge dated March 8th, 1911, securing £60,000, has been filed.

Barbados Electric Supply Corporation, Ltd.—Issue on March 3rd, 1915, of £500 debentures, part of a series of which particulars have already been filed.

Stella Conduit Co., Ltd.—Mortgage on land and premises, known as Highfield Works, Ash Street, Bilston, Staffs., dated April 19th, 1915, to secure all moneys due or to become due from the company to Lloyds Bank, Ltd., Temple Row Branch, not exceeding £2,100.

Harrow Electric Light and Power Co., Ltd. (44,529).—Capital £50,000 in 6,667 ord. and 3,333 pref. shares of £5 each. Return dated March 11th, 1915. All shares taken up; £50,000 paid. Mortgages and charges, £26,325.

Isle of Wight Electric Light and Power Co., Ltd. (53,823).—Capital £150,000 in 20,000 ord. and 10,000 pref. shares of £5 each. Return dated April 9th, 1915. All shares taken up; £150,000 paid. Mortgages and charges, £92,355. (Originally registered in 1897 as the Ventnor Electric Light and Power Co., Ltd. Re-named in 1900.)

Oswestry Electric Lighting and Power Co., Ltd.—Issue on March 2nd, 1915, of £300 debentures, part of a series of which particulars have already been filed.

Newtons, Ltd.—Particulars of £10,000 debentures, created March 23rd, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £500 (renewals). Property charged: The company's property, present and future. No trustees.

Novelty Construction Co., Ltd.—A memorandum of satisfaction to the extent of £265 on April 12th, 1915, of debentures dated May 31st, 1912, securing £915, has been filed.

Carville Site and Power Co., Ltd.—Issue on April 28th, 1915, of £10,000 debentures, part of a series of which particulars have already been filed.

CITY NOTES.

Shanghai Electric Construction Co., Ltd.

THE directors report for 1914 a profit of £33,602, compared with £34,726 for 1913. There has been transferred to reserve for renewals account £10,000, and in reduction of the preliminary expenses account £1,000; a dividend of 6 per cent. for the year (less income tax) absorbs £19,200, leaving to be carried forward £4,703.

The loss by exchange on subsidiary coinage in 1914 was £28,038, which is equal to 8¾ per cent. on the capital of the company. Profits have been converted into sterling at an average rate of 1s. 9¼d. to the Mexican dollar, as against 2s. for the preceding year. During the year the increased depreciation of subsidiary coinage, and the fall in the exchange of silver into sterling, combined to affect profits adversely to the extent of over £7,000 as compared with the company's experience in these respects in 1913. For the first half of the year the number of passengers, and the amount of gross receipts and operating profit, showed a satisfactory expansion, which was to a large extent neutralised during the remainder of the year by the less favourable conditions following upon the outbreak of war. Thirteen new motor cars and 15 new trailer cars were completed during the year, and a further 10 new motor cars have been completed since the close of the year.

Railless traction was introduced with seven cars in Fokien Road in November last with satisfactory results as regards receipts, but was suspended in consequence of the road bed being found unsuitable. Fokien Road is accordingly to be reconstructed in concrete, to the initial cost of which the company will make a moderate contribution. Traffic conditions will be materially improved by the reconstruction, and the Municipal Council will reduce the charge to the company for road maintenance. The directors announce with great regret the death of their colleague, General Albert Thys.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.

THE directors in their report show that the drop in the profit for the year 1913 was due to exceptional causes; the result for 1914 is well up to the average of previous years. The dividend on the preference shares has been maintained at 4 per cent., and a debenture redemption fund has been inaugurated by the allocation of £7,000 for this purpose. The sum of £6,500 has been written off to depreciation for the year, leaving, after payment of the debenture interest, £846 on profit and loss account to be carried forward. The money set aside in previous years as a "reserve for depreciation and renewals" having been expended, has, with the approval of the auditors, been written off. The war has not interfered with the company's operations and did not add much to its operating costs during the past year. During the current year the company will be affected by increased taxation demands both in Australia and this country. Its operating costs will also be somewhat increased as nearly every item of stores and supplies is costing, and is likely to cost, a higher figure.

Annual meeting: May 25th.

Anglo-American Telegraph Co., Ltd.

MR. F. A. BEVAN (Chairman) presided on Friday, at Winchester House, E.C., over the annual meeting. He said that they had during the year received the rent payable under the lease with the Western Union Co., which sufficed to pay the dividends on the three classes of stock. As they were aware, the deferred dividend was payable at the end of each year, and the proportion of the quarterly rental that represented such deferred dividend was accordingly retained and invested on the best terms that the directors could secure. As a result, £1,308 was received in respect of interest on bank balances and loans, which with the amount previously earned produced £5,625. That sum, subject to the requirements of the company from time to time, the directors were advised was available for distribution amongst the deferred stock holders and the ordinary stock holders. It had been suggested that the directors should make an immediate distribution of this sum, but they had come to the conclusion that the amount was too small, looking to the large number of deferred stock holders and to the very small sum that would consequently pass to them. They thought it would be advisable to wait until they were able to distribute, say, ½ per cent. upon the deferred stock, including, of course, the ordinary stock holders' interest in that stock, which would absorb £8,750, towards which, as he had said, they had £5,625 in hand. In the renewal fund

account it would be seen that they had received the annual contribution of £20,000 from the Western Union Telegraph Co., as stipulated in the lease, and £2,487 as interest and dividends on investments, which with the amount brought forward from the previous year gave a total of £153,099. Out of that they had had to pay the cost of new cable inserted during the repair and renewal of the cables, amounting to £44,933, and they had also paid £43,800 on account of the new cable repair ship. In respect of that, there was a further liability of approximately £37,000 to be paid before the ship came into their possession. They had for several years been considering plans for a new cable ship to replace the old one, which was in such a condition that it was imperative that it should be replaced. Accordingly, under the agreement with the Western Union Co., they entered into a contract for a new ship, the total cost of which would at the outside be £81,000. In ordinary circumstances the ship would by now have been completed, but owing to the war, private contracts had to stand aside for Government work; but they hoped to get delivery of the ship before the autumn. They were fortunate in having concluded the contract before the war, or the price would have been increased 30 or 35 per cent. In order to make the payment for the new cable and ship, it was necessary to realise investments, and this resulted in a loss on the sale of £3,632. Whilst this was a matter to be regretted it was, of course, one they were powerless to prevent, and when one considered the heavy depreciation in all classes of securities they would agree they could congratulate themselves that the loss was limited to the small sum stated. As to the renewal fund, it could only be a matter of time when the balance would be eliminated from the accounts. At the moment the balance was £60,625, of which £41,867 represented the cost of investments. Since the date of the balance sheet the majority of the securities had been sold to make further payments on account of the new ship, and he need scarcely say that they had been sold at a substantial decrease on the cost price. The securities which had not been sold were for the time being practically unsaleable, and if disposed of in these times there was very little hope of their getting back the money paid for them. The £65,000 was based on the cost of investments, and required to be depreciated accordingly. What it would amount to no one could say; but at the present moment they might assume that they had an actual balance on the renewal fund of £55,000, of which £37,000 was required to complete the payment for the new ship, leaving approximately £18,000 to the credit of the fund. An arrangement had been come to with the Western Union Co. whereby the directors had agreed that so long as any balance remained upon the renewal fund the cost of new cable inserted in the course of repairs to the companies' cables should be paid for out of the fund. What the cost of cable so inserted in the current year would be he could not say. Last year it amounted to £44,000, and as the 1873 cable was interrupted now in deep water, he feared it might be necessary to insert a long length of new cable, and if this be so, then the cost of that new cable would absorb not only the £18,000 which remained in the renewals fund, but also the annual contribution of £20,000 to the fund payable by the Western Union Co. at the end of the year. If these amounts were insufficient to pay for the new cable, then, of course, it would devolve upon the Western Union Co. this year to find the balance, and in all future years to bear itself the whole cost of the repair and renewal of the companies' cables. The Chairman next dealt with the pension fund, and said that the report of the actuary showed that a contribution of £6,970 was required from the Western Union Co. In conclusion, he was pleased to say they remained on the friendliest terms with their lessees, who paid their rent with commendable promptitude.

Mr. R. H. Benson seconded the motion.

The report was adopted.

Replying to a vote of thanks to the board and staff, the Chairman said that next year he would complete 50 years as a director of the company.

Lisbon Electric Tramways, Ltd.

The annual meeting was held on May 12th, at the offices, 1, London Wall Buildings, E.C., Mr. Ludwig Breitmeyer presiding. The Chairman, after referring with regret to the death of the late Secretary, Mr. S. W. Jameson, said that during the last five months of the year a period of exceptional trouble came unexpectedly upon them, and although they escaped direct interference from the war, owing to the locality of their undertaking in a neutral country, they felt the reflex action by the increased cost of fuel and other supplies, and, further, by the great fall in the Portuguese exchange, which dropped from 46d. to about 36d. All those adverse factors, which were quite beyond their control, brought about a decrease in the profit of about £20,000. The traffic returns showed steady records from year to year, and were an evidence that the business was on a sound and healthy basis. Unfortunately, in the current year the unsatisfactory conditions to which he had referred still prevailed, and until the war was brought to a conclusion they must expect to suffer under the higher costs of operation and the depreciation in the international exchange. It had not been possible out of the year's profits to make the usual appropriation of £35,000 to depreciation reserve. Only £15,000 had been set aside from this source, but in order to bring the amount to approximately the figure of £35,000, the sum of £19,012 formerly standing to the premium on ordinary share capital had been utilised for the purpose. In addition, as in former years, they had placed £5,000 to exchange reserve account, bringing it up to £55,000. The shareholders would now see that the policy of creating this reserve was a wise one and was justified by events, and the precaution of providing ample reserves in the past now enabled them to maintain the present dividends. Capital expenditure to the extent of £51,000 had been incurred during the past year, which should add to the revenue-producing power of the company. Two of the most important of the Ascensores lines were now open to traffic, and the conversion of the remaining three inclines of this system to electricity was nearing completion. The extension of the power house plant was finished, and were it not for the high prices obtaining for fuel, a great saving in this connection over previous years would have resulted. The price of coal before the war was from 22s. 6d. to 25s. per ton; now it ranged between 37s. 6d. and 40s.; their annual consumption was between 19,000 and 20,000 tons. He regretted to say that the negotiations with the Lisbon Municipality regarding the interpretation of some clauses in the concession had made no further progress. A new Council had recently been nominated by the Government, and they hoped that their endeavours in the future for effecting an equitable settlement would be met in a more reasonable and conciliatory spirit. On the whole, he thought they could congratulate themselves on the outcome of the past year's working, for, although the net result was not so favourable as formerly, the actual business of the company was as good as ever, and the reduction of the profits from £129,000 in 1913 to £110,000 last year was only due to temporary causes brought about by the present European upheaval, and which they hoped would pass away with brighter days. From present indications he did not think he was too optimistic in anticipating a further increase in the revenue during the current year. Of course, no accurate forecast was possible—all depended on the duration of the war; and he sincerely hoped that before they met next year a permanent and beneficial peace would have been obtained.

Mr. J. R. Taylor seconded the motion, which was adopted.

Subsequently, on the motion of Sir Lionel Phillips, a resolution was passed voting 100 guineas to the Red Cross Society.

West India and Panama Telegraph Co., Ltd.

Mr. W. B. Kingsford presided at Winchester House, E.C., on May 12th, over the annual meeting. He first referred in feeling terms to the loss sustained by the company by the death of Sir J. Cameron Lamb. The vacancy had been filled by the election of Sir A. F. King, K.C.B. The revenue was more than that for the corresponding period, and although the expenditure was somewhat heavy yet the ratio of expense to income was slightly less than in the December period of 1913. The half-year's working showed a net profit of £18,683, an increase of £5,614. Some part of the increased expenditure was of a permanent nature. There were certain items, however, which were directly due to the exceptional conditions that had prevailed during the last five months of the half-year under review, and they hoped that when peace returned they would be able to effect economies on these items. Ever since the outbreak of war they had been obliged to carry on their business under such varied and unusual conditions that it was almost impossible for him even approximately to forecast the future. The strict, but necessary, censorship which since last August had been in force at most of their stations, and the partial prohibition of the use of codes throughout the West Indies, had very much hampered business, and had so greatly disturbed their normal working conditions as to cause the directors some anxiety as to the probable future effect upon their earnings and upon the profits of the company. He might remind them that these were already adversely affected by the reduction in the rates which came into force on October 1st. These greatly reduced rates had, no doubt, been a great boon to the telegraphing public. Thus far, however, he regretted to say that the growth in the volume of traffic gave little reason to hope that the lower rates would be compensated for by new business, at any rate, while the restrictions already referred to continued to be in force. He told them at the last meeting that since the war they had been required, and they were still required, to keep their stations open day and night, thus costing them very much extra expenditure and subjecting their operating staff to very severe strain. Their clerks had worked admirably throughout this very trying emergency, and they felt that great praise was due to them for their loyal and willing service. As regarded their investments, in respect of the reserve fund as at December 31st last the war made it quite impossible for them in some cases to obtain reliable quotations. As stated in the report, the depreciation amounted to £15,000. It was unlikely, however, that they would need to sell securities, and therefore it might be reasonably hoped that with the return of normal conditions that depreciation would be reduced.

Mr. H. W. Birks seconded the motion.

The report was adopted, and a vote of thanks passed to the board and staff.

Great Northern Telegraph Co., Ltd., of Denmark.

The receipts for 1914 amounted to £792,038, and the expenditure was £250,590, leaving a net profit of £541,447. It is proposed to put to reserve and renewal fund £111,111, to pension fund of staff £11,111, directors' remuneration £2,500, dividend and bonus 22 per cent. £330,000, carrying forward £86,725.

The annual meeting was held at Copenhagen on May 8th. Rear-Admiral F. C. C. Bardenfleth, D.R.N., rendered an account of the working of the company during the year 1914 on behalf of the Chairman (Commodore E. Suenson, D.R.N.), who was prevented by illness from being present. He said that the terrible war, which had not only set aflame the most important countries in Europe, but had also spread the conflagration to the Far East and to almost every other part of the globe, had compelled all the governments, belligerent as well as neutral, to adopt certain measures for the exercise of control over the telegraphic and postal services. As a result of these measures this company's accounts with other administrations had been much delayed, and for this reason the directors had been obliged to postpone the general meeting. The strict neutrality observed during the war by the Danish Government, as well as by the Governments of Sweden and Norway, had made it the plain duty of the company to follow similar principles in its dealings with the administrations of the several countries in which the company's cables were landed. They had always, however, in times of peace as well, followed these principles of neutrality and discretion, and had thereby gained the absolute confidence of the governments concerned in the perfectly impartial and loyal service of the company. This confidence had not been withdrawn during the war. In 1914 fifteen interruptions had occurred to ten cables in Europe, whilst, in the Far East, six cables had suffered 28 interruptions. The company's cables in the Baltic, between Denmark and Russia, became interrupted towards the end of November last year, and, unfortunately, owing to the war, it had not yet been possible to repair them. In Europe the cable steamer *H. C. Orsted* had been occupied for 105 days, of which 32 days were for the account of other administrations; in the Far East the cable steamers *Store Nordiske* and *Pacific* had been occupied for 188 days, of which 41 and 6 respectively were for the account of others. The Vladivostock and Kiachta routes had worked very satisfactorily and carried a considerable part of the traffic exchanged between Europe and the Far East; but the said traffic *via* the company's lines had sensibly decreased since the war broke out. The line in Mongolia between Kiachta and Peking had been overhauled during the year; a constant supervision was, however, required to keep the line in efficient working order. The Japanese Government cable between Shanghai and Nagasaki, to the establishment of which this company consented during the negotiations mentioned in the reports of the last two general meetings, was opened for traffic on January 1st, 1915, after the Japanese Government had secured the necessary consent of the Chinese Government. The cable, according to existing arrangements, is only to be used for the transmission of telegrams written in Japanese Kana characters and for Government telegrams exchanged terminally between Shanghai and Japan. In the spring of last year a convention was concluded between the Russian and Japanese Governments regarding the junction, at Sakhalien and at the frontier of Chosen, of the telegraphic systems of the two Governments. The rates for telegrams exchanged terminally *via* these new connections between Russia and Japan had been fixed at very low figures and in such a manner as to preclude the company's Vladivostock-Nagasaki cables from competing for the said traffic at equal rates. The traffic of which they were thus deprived, and which they had vainly tried to retain for their route by a heavy reduction of their rates, was not inconsiderable; in other respects the convention did not affect the company's rates or traffic. The negotiations with the Chinese Government were rather protracted, and it was only in the month of August last year that a final settlement was arrived at. The arrangements thus concluded mainly secured for the company the Chinese Government's approval of, and co-operation in, the arrangements entered into with Japan in 1913. The traffic over the company's cables had been extremely heavy during the war and continued so, especially in Europe. At the outbreak of the war all the direct connections between the telegraph systems of the United Kingdom, France and Russia on the one side and those of Germany and Austria-Hungary on the other side were naturally broken off. The burden of all the telegraphic correspondence between Russia and her allies was cast upon the company's system, whilst other classes of traffic also increased considerably over and above the normal, the average number of words contained in the telegrams being increased, owing particularly to the universal prohibition of the use of code. In these circumstances a very heavy task devolved upon the company's staff. The death of Colonel E. V. Tychsen, a director, occurred last December. Mr. W. Weimann had been asked to take his place. From the 1st July, Mr. F. C. C. Nielsen, after about 45 years' active service in the company, had, owing to failing health, tendered his resignation as the company's representative in England, a position which he had filled with conspicuous ability for over 24 years. Mr. Nielsen had consented to be retained in a consulting capacity and thus give the company the benefit of his great experience and intimate knowledge of its affairs in England. Although the financial results of the year 1914 had been eminently satisfactory, the increase of the receipts, being due to the war, was a temporary one only. "This fatal war, through which the company prospers for the time being, may still entail grave consequences; for nobody is able to foresee whether the fortunes of the war may not to-morrow prevent us from pursuing our peaceful work, nor is it possible to foretell whether the results of the war in Europe and in the Far East will allow us to continue the working of the cables under the same conditions as those which prevailed before the peace was broken." Notwithstanding that the company may at any moment be placed in a difficult position, the board of directors is glad that the unexpected increase of the receipts warrants the distribution of a total dividend and bonus for the year of 22 per cent. At the same time, the board proposes, as an exceptional measure, to add a further £55,556 to the reserve and renewal fund, a proposal which is justified by the continued depreciation of the investments, amounting to about £188,000, during the years 1912, 1913, and 1914.

Electric Construction Co., Ltd.

The directors report that for the year 1914 the net profit, after providing £6,800 for debenture interest and £5,000 for depreciation, is £35,567, plus £7,153 brought forward, making £42,721 available. After paying 7 per cent. on the preference shares for the year ended March 31st, 1915, a dividend at the rate of 6 per cent. per annum on the ordinary shares is recommended requiring £13,452, transferring to general reserve fund £17,403, and leaving £7,471 to be carried forward. "The directors are pleased to be able to report a good general demand for electrical machinery, which has been enhanced by special orders arising out of the declaration of war. The extension of the company's works, reported last year, has enabled these orders to be executed promptly and economically. The volume of unexecuted orders is satisfactory. The directors report with regret the death of their colleague, Mr. William Bulloch. Mr. David Willock, who has been in the service of the company for 18 years, has been elected to fill the vacancy on the board. As indicated at last general meeting, the directors have, by the transfer of a sum from general reserve, reduced the amount in 'shares in other companies' to what is considered the realisable value. The amount remaining at the credit of general reserve, after making the contribution recommended from last year's profits, will be £36,000."

Annual meeting: May 27th.

West African Telegraph Co., Ltd.

Presiding on May 12th at the annual meeting, held at Electra House, E.C., Sir J. Denison Pender, K.C.M.G., said that the gross receipts for the year amounted to £55,500, an increase of £9,600. That improvement in the receipts was mainly due to the naval and military operations on the coast which were taking place in connection with the war. The sum received in the year under review for messages was £42,600, as compared with £34,600, or an increase on message account of £8,000. The amount received as interest and dividends on the reserve fund investments was practically the same as in the preceding year. The total expenses were £26,100, against £29,600 in 1913, thus showing a decrease of about £3,500, chiefly owing to a smaller expenditure on cable repairs. The amount expended on cable maintenance varied considerably from year to year, and, as he had repeatedly pointed out, the expenses formed no criterion as to what the cost was likely to be. In 1913 they spent under that head £12,000; this past year only £7,000; yet the same care and foresight had been exercised in each case. The general expenses in London for the past year were £2,735, against £2,718, while the working expenses at stations were £11,490, as compared with £11,678. The only item which called for remark was £434, which represented the contributions made by the company to various war relief funds—an expenditure which he was sure would meet with their entire approval. The net result of the year's working was that, while maintaining the usual dividend of 4 per cent., they had been able to carry the very respectable sum of £19,000 to the general reserve fund, which now stood at the nominal figure of £315,000. It must, however, be borne in mind that the securities representing that fund had depreciated in value, although, owing to the present restriction in Stock Exchange operations, it was difficult to tell to what extent depreciation had actually taken place. Fortunately for them there was no necessity at this time to realise any part of the reserve fund, and the interest they received from it, which formed part of their revenue, was in no way disturbed.

Sir Henry C. Mance seconded the motion, and the report was adopted.

German Electrical Companies.

The Ver. Isolatoren Werke A.G., of Pankow, reports a declining period of prosperity in 1914. The provision made for depreciation amounts to £2,800, as compared with £5,900 in 1913, leaving net profits of £590, as against £6,600. It is not possible to pay any dividend, this result comparing with 9 per cent. in the preceding year. It is stated that owing to army orders the new financial year has started favourably.

The Hamburg Hochbahn A.G. records the transport of 36,178,190 passengers in 1914, as compared with 39,000,969 in 1913, and receipts amounting to £250,000, as against £263,000. After defraying working expenses of £140,000, as contrasted with £139,000, and deducting the necessary payments to the State and making provision for reserve fund, the accounts indicate net profits of £33,000, as against £47,000 in 1913. The directors recommend a dividend of 4 per cent., as compared with 5½ per cent. in the preceding year.

The Deutsche Kabelwerke A.G., of Berlin-Lichtenberg, states that the company was well employed during 1914, and realised slightly greater profits than in the preceding year. After allocating £14,000 to depreciation, as against £16,000 in 1913, the net profits are returned at £41,000, as compared with £34,000. It is proposed to pay a dividend of 6 per cent., as contrasted with 8 per cent., to devote £11,000 to the writing down of the machinery to the value of one shilling, and place £3,700 to a war reserve fund, and £4,000 to the special reserve fund, leaving £1,700 to be carried forward, as against £3,400 in 1913.

The report of the *C. Lorenz A.G., of Berlin*, shows, after writing off £22,000 for ordinary depreciation and £5,000 off a Russian investment in Petrograd, net profits of £80,000 in 1914 on a share capital of £70,000. It is proposed to pay a dividend of 25 per cent., as compared with 20 per cent. in 1913, and a bonus of 7½ per cent., as against 6 per cent., out of the net profits, which include those derived from the business connection with the High Frequency Machine Co. It is now intended to increase the ordinary capital to £150,000 by the issue of new shares at a premium, for the purpose of strengthening the company's financial resources.

The Elektrizitats Lieferungs Gesellschaft, of Berlin, which owns 21 electricity supply works and holds a lease of several others, reports that the development of business was satisfactory until the war, when a contraction took place; but shortly afterwards a favourable course was resumed by most of the works. The scarcity of petroleum which occurred exercised a stimulus on the supply of the electric light and brought many additional customers to the company, whose custom was doubtless permanently assured by the recognition that oil lighting could no longer compete with electric lighting with economical lamps. It was of advantage to the company that, with the exception of the works at Craiova, Rumania, all the undertakings were situated in Germany. The accounts indicate gross profits of £287,000, as against £310,000 in 1913, and net profits amounting to £179,000, as compared with £213,000. It is proposed to pay a dividend of 10 per cent. on ordinary share capital of £1,500,000, as contrasted with 12 per cent. in 1913, the loan capital totalling £1,450,000.

The Deutsch-Sudamerikanische Telegraphen Gesellschaft, of Cologne, reports net profits amounting to £52,000 for 1914, as compared with £56,000 in the previous year. It is proposed to distribute 6 per cent. as against 6½ per cent. in 1913, and to place £2,600 to the legal reserve fund, £7,500 to the contingency fund, and £2,500 to the benevolent fund, being the same sums respectively as in 1913.

The balance sheet of the *Heddernheimer Kupferwerk und Suddeutsche Kabelwerke, of Frankfort-on-Main*, after apportioning £18,000 to ordinary depreciation in 1914, as against £20,000 in 1913, shows net profits of £66,000, as compared with £57,000. It is intended to set aside £16,000 for reserve funds and extra depreciation, as in 1913, and to pay a dividend of 7 per cent. as in the previous year, leaving £11,000 to be carried forward.

The Felten und Guilleaume Carlswerk A.G., of Cologne-Mulheim, reports net profits of £300,000 for 1914, as contrasted with £321,000 in 1913. The former total has been arrived at after a careful valuation of the credit held abroad and the allocation of £25,000 to special depreciation of machinery and apparatus. A dividend of 8 per cent. is in contemplation, as in the previous year, and the sum of £30,000 is to be assigned to the disposition fund for works, as in 1913.

The Bergmann Elektrizitats Werke A.G., of Berlin, record gross profits amounting to £555,000 for 1914, as compared with £579,000 in the preceding year. General expenses, interest charges, taxes, etc., absorb £215,000, as against £257,000, and depreciation requires £158,000, as contrasted with £135,000 in 1913. The balance permits the payment of 5 per cent., as in the previous twelve months, the appropriation of £50,000 for a war reserve fund, and the carrying forward of £17,000, as compared with £16,000 in 1913.

The report for 1914 of the *Kabelwerk Wilhelminenhof, of Berlin*, states that the working results did not remain uninfluenced through the outbreak of the war. Nevertheless, the company could again submit satisfactory accounts, and as it did not appear necessary further to strengthen the reserve fund it was possible to recommend the same rate of dividend as in the preceding year. Including the balance brought forward, and after allocating £2,800 to depreciation, as against £1,500 in 1913, the net profits are returned at £10,500, as contrasted with £13,600. The dividend amounts to 15 per cent., as in 1913.

The directors of the *Land und Seekabelwerke, of Cologne-Nippes*, whose share capital of £300,000 is held entirely by the Felten & Guilleaume Co., state that satisfactory results were obtained in 1914, although a portion of the year stood under the influence of the war. The gross profits were £67,000, as compared with £73,000. After defraying general expenses and setting aside £12,000 for depreciation, as against £15,000, the accounts indicate net profits of £35,000, as contrasted with £38,000 in 1913. A dividend at the rate of 10 per cent. has been declared, this comparing with 11 per cent. in the previous year.

The Gesellschaft fur Elektrische Unternehmungen, of Berlin, which has an ordinary share capital of £3,000,000 and loan capital of £2,023,000, owns, or is otherwise financially interested in, many lighting and tramway undertakings both in Germany and in Russia, France and other countries. The directors' report for 1914 states that, with few exceptions, the supply works in the homeland had been prejudiced in their development through the war, whilst those in neutral countries had been similarly affected to a lesser degree. The tramway undertakings had suffered to a greater extent. On the other hand the undertakings in hostile countries, particularly in Russia, had been placed under State control, although it was impossible to form a definite opinion as to their ultimate fate. The accounts indicate net profits amounting to £261,000, as against £318,000, and it is proposed to pay a dividend of 6 per cent., as compared with 10 per cent. in each of the three preceding years.

The report of *Voigt und Haeffner A.G., of Frankfort-on-Main*, states that working was unfavourably affected in the first months of the war in consequence of the decisive stagnation in railway traffic, and it was only possible to provide some compensation towards the close of the year by embarking upon the production of parts of munitions of war. The requirements in peace manufactures also increased to some extent. But taken as a whole there was a substantial decline in the results over the previous year owing to the large reduction in the turnover, which was all the more comprehensible as it was impossible to curtail the expenses, and the army orders would only appear in the accounts for 1915. As gross profits the accounts indicate the sum of £110,000, as compared with £164,000 in 1913; and general expenses absorb £52,000, as against £50,000; and depreciation £11,000, as contrasted with £13,000. The net profits and balance forward total £49,000, as compared with £104,000; and the dividend is 8 per cent. on a share capital of £250,000, being 4 per cent. less than in 1913.

The report of the directors of the *Deutsch-Atlantische Telegraphen Gesellschaft*, for 1914, states that during the first seven months an increase in the traffic took place over the corresponding period in the previous year, and an advance was also recorded in the receipts. It was possible for the company to secure a further acceleration in the speed of transmission through the cables. Early on August 5th both cables between Emden and Fayal, in the Azores, and the cables between Emden and Vigo were cut in the Channel beyond the limits of English and French sovereignty, and, in point of fact, evidently on the part of the English. It was at present impossible to foresee when the restoration of the cables and the resumption of working could be effected. The Norddeutsche Seekabel Werke, in which the company is interested, would pay a dividend of 4 per cent. for 1914, but the share devolving upon the Atlantic Co. would first be included in the latter's accounts for 1915. The accounts show the following figures for 1914 as compared with those in the preceding year:—

	1914.	1913.
Share capital	£1,200,000	£1,200,000
Loan capital	873,500	888,500
Gross receipts	225,000	296,000
General expenses	77,000	63,000
Cable repair and redemption funds	32,000	34,000
Depreciation	6,000	7,100
Net profits and balance forward	103,000	173,000
Dividend	78,000	90,000
Dividend per cent.	6½	7½
Carried forward	16,000	33,000

The fact that the rate of dividend has only been reduced by 1 per cent. is due to the larger amount brought forward in 1914 as contrasted with 1913; the allocation to the reserve fund is less by £11,000, and directors' fees and bonuses are lower by £28,000 than in 1913. The liabilities of £81,000, as against £68,000 in 1913, consist of unsettled accounts with the Eastern Telegraph Co., the Europe and Azores Telegraph Co., the Commercial Cable Co., the savings' account of the officials, and certain other debts.

Anglo-Argentine Tramways Co., Ltd.—The directors report that owing to the decrease in traffic receipts for the current year as compared to 1914, and the uncertainty of the outlook, they do not recommend any dividend on the ordinary shares. £96,409 is being carried forward, as compared with £13,421 brought in from 1913.

United River Plate Telephone Co., Ltd.—Final dividend on the ordinary shares, 5 per cent., making 8 per cent. for the year. £6,563 is to be carried forward.

Eastern Telegraph Co., Ltd.

THE annual meeting was held, on May 12th, at Electra House, E.C. Sir J. WOLFE BARRY, K.C.B., who presided, said that the gross revenue for the year was £1,645,000, which was about £183,000 in excess of the previous year. On the other hand, the total expenses during the same period had been correspondingly heavy. From one cause and another they exceeded those for 1913 by about £107,000. There was also an increase of about £3,500 in the interest on 4 per cent. mortgage debenture stock, due to the issue of £103,294 of this stock in November, 1913, to meet some additional capital expenditure. The result of the year's working, therefore, was that after providing for the usual dividends on the various stocks, and the same bonus as formerly—viz., £2 per cent. for the year on the ordinary stock—they were able to carry to the general reserve fund £390,000, the same amount as in 1912. This fund had been charged during the year under review with about £274,000 in respect of new cables and other special expenditure, so that the net addition to the fund for the year was about £116,000. There still remained to be charged £200,000, being the balance of cost of the Aden-Colombo cable. This would be dealt with during the current year. They would no doubt have noticed that the amount set aside as a provision on account of investment fluctuations, which was shown at £325,000, had not been altered this year. When he last had the pleasure of addressing them he pointed out that the operation of varying some of their investments had resulted in an actual realised loss on securities sold of about £66,000, which had been charged against the general reserve fund. Although after having done this the approximate depreciation was still slightly in excess of the provision made, there had subsequently been an improvement in the total value of the securities, and they did not think it necessary to increase the provision of £325,000. As the Stock Exchange was closed on the date to which the present accounts were made up, the usual method of valuation could not be adopted, and they felt that even now it was difficult to arrive at anything like an accurate appraisement. They had therefore decided to hold the matter over until the end of the current year, when it was hoped that they might be able to arrive at something more definite; and if the depreciation of the securities seemed to require that course, they would then consider the desirability of increasing the provision now made. He might incidentally remark that the renewals of some of the older sections in the Red Sea, and the new cable from Aden to Colombo, had materially assisted them in maintaining a satisfactory service to India and the Far East during the exceptional times of pressure which they had experienced, and which still existed, more especially as the alternative route to India by the Indo-European Co.'s system had been continuously interrupted since July 31st last, and the Government Pacific cable to New Zealand and Australia was also interrupted from September 8th to November 5th. If further proof were required of the importance of maintaining a substantial reserve fund, it could be found in the example now before them, which showed that they had been able to carry out this important work at a cost of about one million pounds, the whole of which had been met by appropriations from the reserve fund. This policy, which the directors had so consistently followed throughout, enabled them to meet any exceptional and unforeseen demands whigh might arise, more particularly at a time such as the present, when so much pressure of work had been so suddenly placed upon them. This great war had been so far reaching, that practically every part of our widespread Empire had been seriously affected, and the necessity for rapid trustworthy means of communication between the Mother Country and the Oversea Dominions had been more than ever realised. Their aim had been not only to improve the speed of their service, but to render it as secure as possible against total interruption. With only a single cable this might occur at any time, either from natural causes or, in the event of war, from the malicious acts of enemies. In order, therefore, to provide an efficient permanent service they had taken, for years past, the precaution of connecting the most important points of their system by several cables laid along widely different routes. He knew that their work was appreciated by the Government, and they were glad to feel that they were able to render a useful service to the country. Although certain restrictions had necessarily been imposed by the Government in the regulations affecting commercial, Press and social telegrams, it must be a satisfaction to all concerned that they had been able to maintain a constant service throughout their system. Having referred to the action of the Government in taking possession of the company's offices and controlling the traffic, and the consequent restrictions placed upon private and public telegraphing, as outlined at the meeting of the Eastern Extension Co., the Chairman said there was another matter arising out of the war which he ought to mention. By an agreement dated May 28th, 1878, certain arrangements were made between the company and the Indo-European Telegraph Department of the Indian Government and the Indo-European Co., for maintenance of alternative routes, pooling traffics and dividing receipts in agreed percentages, with the usual provision that in case of interruption of either route for a specified time, the interrupted company should cease to participate in the receipts. The advantages of the agreement were fully explained by his predecessor in the chair to a general meeting held on July 11th, 1878, when the agreement was unanimously approved and full powers were given to the board to carry it into effect, or modify details. Part of the Indo-European route passed through enemy territory, and that service to India was completely interrupted; but the maintenance, or rather re-establishment, of an allied route was as much to their interest now as in 1878. The directors had, therefore, decided to extend the rates and continue the payments mentioned in the agreement, so as to give the Indo-European group a reasonable opportunity of establishing an efficient alternative route after the war. Before concluding, he wished to record their appreciation of the patriotic devotion and the high sense of duty shown by the staff on shore and on board their cable repairing ships during a time of such great anxiety to them all. The good results to which he had referred could not have been achieved without their whole-hearted co-operation under trying and sometimes risky conditions. The ships' staff had done valuable work in maintaining communication, and the shore staff had dealt with the traffic as expeditiously as possible under the conditions of censorship imposed by the Government. They had been working long hours during week-days, Sundays, and holidays, and all, both on board ship and on shore, had cheerfully given up their periodical furloughs in order to meet the demands of their country. In saying this, he included not only the staff abroad, ashore and afloat, but also in a marked degree the head office staff and their employés at the stations in Great Britain. It being impossible speedily to replace their highly trained and technical staff, the authorities did not desire them to enlist; and although many of them would have liked to take a more active part in the war, they had—with some few exceptions—accepted the ruling of the Army Council, who had expressed the view that, having regard to their special qualifications, they were serving their country better by remaining at their posts than by joining the fighting forces. A large percentage of the administrative staff at head office had, however, joined the Forces, and although their work was more or less of a special character, they had given every facility to the eligible men to join the active services, and had agreed to reinstate them when they returned. They were at present granting them full pay. The temporary vacancies thus created had, to a large extent, been filled by the employment of experienced female clerks who had lost their permanent situations owing to the war. They would be glad to hear that at the cost of their stations', ships', and head office staff, a very efficient repairing ambulance car had been equipped and placed at the disposal of the Red Cross organisation for the service of the British Forces, and that the staff had made, and were making, regular and handsome contributions to the Prince of Wales' Fund.

Sir J. DENISON PENDER, K.C.M.G., seconded the motion, which was adopted without discussion.

Calcutta Electric Supply Corporation, Ltd.

THE annual meeting was held, on May 13th, at the offices, 2, Broad Street Place, E.C. Mr. PAGET V. LUKE, who presided, said that the capital expenditure during the year (£61,443) had been necessitated by the normal expansion of the business and was an indication of satisfactory progress. In order to provide the funds necessary for capital expenditure on additional plant and mains, the directors issued £100,000 of additional capital last January; half in ordinary shares at a premium of 10s. per share, and half in preference shares at par. The shares were fully subscribed and the premium on the ordinary issue, amounting to £5,000, had been added to the reserve fund and invested. In regard to the revenue account, it was particularly gratifying to note the reduction in generating costs, which was a very satisfactory result of the very large capital outlay involved in the high-tension scheme completed in 1913. It would be a sufficient indication of the good results to say that, roughly speaking, in 1914 2¼ million more units were generated than in 1913, while the generating costs were 63,500 rupees less. The principal item in generating costs was coal; and the quantity used had been reduced from 40,064 tons in 1912 to 23,330 tons in 1914, notwithstanding an increase of nearly seven million units generated in that period. The Trades Association of Calcutta recently presented a petition to the Corporation praying for a reduction of charges, both in the price of current and meter rent. The desire for a reduction in the price of current had been already anticipated by the lowering of the cost for lighting purposes, and a reduction of ¼d. per unit came into force from July 1st last. The directors had now decided to reduce the meter rent by one-half as from July 1st next. That concession would mean an annual difference to the corporation of some £7,000. A still further reduction in the price of current for lighting was now under consideration, and it was hoped that shortly it might be possible to arrange for this, but in the present unsettled state of affairs it was necessary to weigh future possibilities very carefully. With regard to the effect of the war upon their prospects, owing to difficulty in obtaining tonnage for shipments, etc., there was a considerable contraction of general business in Calcutta, and a consequent diminution in the sale of current for power purposes for the second six months of the year. On the whole, however, the war had not, so far, affected them to any great extent so far as revenue was concerned, for, notwithstanding the adverse conditions, the amount of current sold for light, fans, and small motors was well maintained. The full influence of the war was hardly felt in 1914, but the

increased cost of materials, higher freights, and increased taxation would no doubt cause it to be more felt during the current year. So far, he was glad to say, the revenue showed no signs of decreasing. Street lighting had made good progress, and was likely to increase as the advantages of the electric light became appreciated. In order to stimulate a new demand that seemed capable of development the directors had sanctioned a special rate of one anna per unit for current for cooking and heating purposes. At the last meeting an inquiry was raised as to the large number of units classed as "unaccounted for." That matter had received the close attention of the directors and the consulting engineer, and a certain improvement was shown in comparing the figures for 1913 with those for 1914, and there was a still further improvement in the current year. Taking everything into account, the results for the past year could not be considered as other than quite satisfactory. Seeing that the profits were sufficient, the directors had decided to recommend the same dividend as last year; but in view of possible contingencies resulting from the war, they would carry forward a larger sum than usual, and they had also decided to place a sum considerably above the normal to the depreciation and renewal fund.

Sir GUILFORD L. MOLESWORTH seconded the motion, and the report was adopted.

Delhi Electric Tramways and Lighting Co., Ltd.

THE directors report that the gross receipts for 1914 were:—Tramway undertaking £9,798, electric supply undertaking (including £2,981 on account of current sold to tramways) £18,887. The revenue from the tramway undertaking shows an increase of 10 per cent. over 1913. The increase is due to the policy of lower fares. The gross revenue from the electric supply undertaking (excluding the supply to the tramway) shows an increase of 19 per cent., and further expansion in the revenue from this branch may be hoped for as soon as additional mains can be installed. The demand for supply for power purposes is satisfactory, and efforts are being made to develop this department of the business. The combined undertakings show a net revenue of £8,163, as compared with £6,252 in 1913 and £2,990 in 1912. After charging general expenditure in London and Delhi, and debenture and loan interest, the profit and loss account shows a profit of £3,938, plus £214 brought forward. There has been put to depreciation reserve account £4,000, to renewals reserve account £74, and £78 is to be carried forward. The result may be regarded as encouraging, in view of the fact that during the latter period of the year a reduction in revenue in both branches of the undertaking has been experienced, due to the war. The whole of the plant and equipment, including rolling stock, has been systematically overhauled during the year, and the expenditure charged to revenue. The upkeep of the cars is still a heavy item, owing to the single motor equipments, and, as soon as funds can be provided, it is the intention to instal cars with double motor equipments, the cost of which will, to some extent, be off-set by economies in maintenance. The new Diesel engine and generator have given satisfaction since their installation in June last. Owing to the continually increasing demand, it has become necessary to provide further plant, and arrangements have been made to provide a link with the Government power station. The cost of the necessary plant, together with additions to feeder cables which are being installed, will have to be met out of surplus revenue, as it is at present impossible to place the contemplated issue of second debentures.

Annual meeting: May 19th.

United River Plate Telephone Co., Ltd.—The directors recommended a final dividend of 5 per cent. on the ordinary share capital, making, with the interim dividend paid on November 2nd last, a return of 8 per cent. for the year to December 31st, 1914, free of income-tax, carrying forward £6,562.

River Plate Electricity Co., Ltd.—The directors announce that the net revenue for 1914 amounted to £31,000, against £42,201 in 1913. A dividend of 8 per cent. on the ordinary stock is recommended, carrying forward £20,512.

Mirrlees, Bickerton & Day, Ltd.—The directors report that for the year ended March 31st the net profit, after providing for depreciation and directors' fees, was £15,608. After paying 7½ per cent., less income-tax, on the ordinary share capital, and placing £5,000 to the reserve fund, £1,753 is being carried forward.

New British Ever-Ready Co., Ltd.—The directors recommend a final dividend of 6½ per cent. on the preference shares, making the maximum of 10 per cent. for the year to March 31st, and 10 per cent. on the ordinary shares for the year, plus a bonus of 2 per cent.

Aron Electricity Meter, Ltd.—A meeting of first mortgage debenture-holders (5 per cent.) is being held to-day at Cannon Street Hotel to consider resolutions modifying the rights of these holders until the end of the war.

Brisbane Electric Tramways Investment Co., Ltd.—The revenue account for 1914, consisting of the dividend received from the Brisbane Tramways Co., Ltd., amounting to £143,904, together with sundry receipts and the amount brought forward from the previous year amounting to £3,809, less charges in London and Brisbane amounting to £3,649, shows an available balance of £144,063, which the directors have dealt with as follows:—Reserve fund (bringing it up to £100,000), £50,000; accidents insurance fund (bringing it up to £10,000), £7,000; debenture stock interest, £18,689; preference dividend, £17,305; interim dividend on the ordinary shares, £24,000. Out of the remaining balance the directors now recommend that a balance dividend of 4s. per share, free of income-tax, be paid on the ordinary shares (making a total dividend for the year of 8 per cent.), and that £3,070 be carried forward. After the above appropriations the renewal and reserve funds of both companies will amount to £230,000, with an aggregate of balances carried forward of £5,952.

Mexican Northern Power Co.—Mr. W. J. Ross, the new president of the Mexican Northern Power Co., has issued a circular to the first mortgage bondholders urging them to subscribe for $1,000,000 prior lien bonds at the rate of $77.50, or $775 for $1,000 of bonds. The money is required to pay debts, complete the Boquilla dam, transmission lines to Parral and Santa Barbara, the sub-station at Parral, and distribution lines, at a total cost of $575,000.—*Financier.*

Castner-Kellner Alkali Co., Ltd.—The directors have declared an interim dividend at the rate of 16 per cent. per annum for the six months ended March 31st, 1915.

Craigpark Electric Cable Co., Ltd.—The annual meeting was held in Glasgow on May 12th. Mr. W. S. Brown, who presided, said the company, like other firms, had suffered through the war. Their output was somewhat down, but that was because a great number of their men had gone to the front, and they were unable to fill the vacancies. They had made some little provision for the dependents of these men, and he thought they were very well able to do so. Their works were now, however, fully occupied. The material turned out at present was of a very solid and good character. It was principally work for the Government, and he understood was giving every satisfaction. Although somewhat down, the output, as a whole, was quite satisfactory. The report was adopted, and Mr. G. A. Buchanan, who it was stated, was at the front engaged in motor ambulance work, was re-elected a director.

Change of Address.—The address of the following companies has been altered to Electric Railway House, Broadway, Westminster, S.W.:—London and Suburban Traction Co., Metropolitan Electric Tramways, London United Tramways, South Metropolitan Electric Tramways and Lighting, North Metropolitan Electric Power Supply, North Metropolitan Electrical Power Distribution, Tramways (M.E.T.) Omnibus, and Gearless Motor Omnibus.

STOCKS AND SHARES.

TUESDAY EVENING.

THIS week's sentiment has gone some way towards banishing the gloom, amounting to depression, which weighed upon markets after the sinking of the *Lusitania*. The United States Note to the German Government was welcomed as being about as much as could have been expected from the Americans at the present time. Its firm tone and the absence of diplomatic verbiage produced a favourable impression after the first hasty generalisations about a blow having been struck at America which the latter could only avenge by declaration of war. With the calming of men's minds, there has returned that normal hopefulness and confidence which have animated the nation throughout; and the Stock Exchange barometer of public feeling already gives signs of improving markets and better prices.

At home, the domestic difficulties of London, brought about by the tramway strike, have followed so closely upon the heels of the anti-German riots that the horrors of the previous week have been to some extent removed to the background. The country, as a whole, has started again to invest money, and once more there are buyers for all the best-class securities.

The tramway strike would in the ordinary way have been held as a bull point for the omnibus companies, but the lurking fear lest the trouble might extend to the ranks of the omnibus employés has prevented any advantage accruing to the stocks and shares connected with the 'bus business. It has been denied, of course, that these undertakings will be affected: and so far as limited personal observation goes, most people will probably agree that they have found the 'bus men well contented with their present lot. It may be recalled that quite recently the employés of the Tube companies received advances in wages, so that the further hint that they, too, might be drawn into the tramway disaffection, savours more of a threat from the promoters of the latter than of inherent likelihood. No particular surprise will be felt at the intention of the London County Council to oppose the Bill for the proposed closer agreement between the Tubes and the London General Omnibus Companies.

Prices of London Tramway issues have been extremely dull for

some time past. The 4 per cent. Debenture stock of the London United Tramways was only 55 when war broke out, and is now about 52. London and Suburban Traction Ordinary stand about 2s. 6d., the Preference at 8s. 9d., and the 4½ per cent. Debenture stock is nominally 63. Metropolitan Trams 4½ per cent. Debenture stock last changed hands at 80¾, and the Fives at 85; while South Metropolitan Electric Tramways Debenture stock, which was 66 at the end of last July, has not been dealt in since the Stock Exchange re-opened. Tramways (M.E.T.) Omnibus 4½ per cent. Guaranteed Debenture keeps its price fairly well at 90.

London General Omnibus Debenture stocks stand at 97 and 87½ for the 4½ per cent. Firsts and the 5 per cent. Income Debentures respectively. Underground Electric 6 per cent. Income Bonds have receded a trifle to 79. The £10 shares have fallen to 32s. 6d., and the shilling shares keep fairly firm, about 5s. 6d. Metropolitan Railway Consolidated stock is dull at 29. Districts remain at 17, there being no sign of animation in Home Rails, except the stocks of the "Heavy" lines. Buyers still want the offer of Central London issues, of the assented variety; and the Ordinary has risen a little to 79.

Sir Edgar Speyer's retirement from his various public positions, including that of the chairmanship of the Underground Electric Railways Company of London, may have something to do with the dulness of the issues in this particular company. From the market point of view, however, it is not thought that the company is likely to suffer materially, inasmuch as it is fully expected that Sir Edgar will continue to exercise his influence upon the direction of the company's affairs, though in a less prominent capacity than that which he has occupied hitherto.

Electric Lighting shares are extremely quiescent, and throughout the list there is not a single change this week. Of the manufacturing issues, Edison & Swan of both classes are rather easier, the fully-paid dropping to 1⅞. Electric Constructions, however, are better at 14s. for the Ordinary and 1 1/16 for the Preference, thanks to the declaration of a dividend on the first-named of 6 per cent., which is an increase of 1 per cent. for the year. Anticipation had looked for a continuance of the 5 per cent. rate, so that the improvement came as a pleasant surprise. There is rather more doing in Castner-Kellners, the company having declared an interim dividend at the rate of 16 per cent. per annum, as against 10 per cent. a year ago; the price of the shares holds steadily to 3¼.

The group of Latin-Canadian companies has been further upset by the death of Dr. F. S. Pearson, who was one of the victims of the *Lusitania*. Dr. Pearson was well known in the City here, and his activities covered a huge range. Many of his interests lay in Mexico, but prices have remained much about the same as they were previously, only the tone of the market showing a certain weakening from what it was before. Mexico Tramway bonds went back 2 points to 56. Mexican Light Preferred eased off to 41. Brazil Tractions lost a point, owing to the unpleasant crumble in the Rio exchange rate, which got back to 12 1/32d., but recovered again to-day (Tuesday). The Argentine Tramways Debentures have drooped also, the Firsts to 81, so that the yield on this stock at the present time is practically 5 per cent. on the money; having regard to the solid nature of the security, the price now must be considered cheap.

Brisbane Electric Tramways Investment Company has declared a dividend of 4s. per share, making the usual 8 per cent. for the year, and the price keeps very steady about 7½, while the 5 per cent. Preference shares are a few pence under their par value of £5. The 4½ per cent. First Debenture stock stands at 98¼. The River Plate Electricity Company has reduced the dividend on its Ordinary stock from 10 per cent. to 8 per cent., but the carry forward of £20,512 is £7,500 better than it was a year ago. The last transaction recorded in the stock was four months ago, when the Ordinary changed hands at 190—some 50 points lower than it stood when the war broke out. No doubt the Company has been affected by the financial and commercial difficulties with which the Argentine Republic has been beset owing to the war.

Telegraph stocks are a little hesitating. Great Northerns are *ex* 34s. dividend, and Indo-Europeans are *ex* 52s. 6d., allowing for which the latter show a rise of 10s. on the week, while Great Northerns are a shade easier. The last-named points out in its report that at any moment the Company may be placed in a difficult position as a result of the development of hostilities. The Company, as mentioned here before, has just raised its dividend from 20 per cent. to 22 per cent.; but the carry-forward of £86,700 is £23,000 less than that for 1913.

The changes in the Eastern group are of insignificant proportions. Cuban Submarines have eased off to 8½ in consequence of the reduction in the dividend to 5 per cent. Cuban Telephone 5 per cent. Bonds came into the market the other day at 80¼. West India and Panama shares have given way a little. The Telephone group keeps very steady. United River Plate Ordinary are to receive their regular dividends of 5 per cent., making 8 per cent. for the year; and the £5 shares changed hands a few days ago at 6 5/16, which is almost exactly the same price as they were at the end of last July. New York Telephone bonds and the Marconi group have fallen upon very quiet days.

Rubber shares are better, thanks to a gradual hardening in the price of the raw material, until now it stands at a shade above 2s. 5d. per lb. A good deal of business is being done in the leading shares, and rather a feature of the past few days has been the improvement in certain of the florin variety which have been standing round about their par price. Copper shares have been on the rise. The giant Amalgamated Company, by the way, is to be dissolved next month, when its assets will be distributed—chiefly in the shape of Anaconda shares. Armaments show comparatively trifling changes. Prices keep hard, but there is scarcely a shilling movement in any of them from the beginning of a week to its end.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend, 1914.	Price May 18, 1915.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.				
Brompton Ordinary	10	8½	—	£6 1 8
do. 7 per cent. Pref.	7	7¼	—	4 10 4
Charing Cross Ordinary	5	4⅛	—	5 11 1
do. do. do. 4½ Pref.	4½	4⅝	—	5 9 1
do. do. City Pref.	4½	4	—	5 12 6
do. 4 Deb.	4	90	—	4 9 0
Chelsea	5	4⅝	—	5 8 1
do. 4½ Deb.	4½	92	—	4 17 10
City of London	9	14¼	—	6 6 4
do. do. 6 per cent. Pref.	6	12½	—	4 18 0
do. do. 5 Deb.	5	11⅛	—	4 9 3
do. do. 4½ Deb.	4½	98	—	4 11 10
County of London	7	11½	—	6 1 9
do. do. 6 per cent. Pref.	6	11⅝	—	5 8 6
do. do. 1st Deb.	4½	100	—	4 10 0
do. do. 2nd Deb.	4½	95 xd	—	4 14 9
Kensington Ordinary	9	7	—	6 8 7
London Electric	4	1¾	—	6 18 0
do. do. 6 per cent. Pref.	6	5	—	6 0 0
do. do. 4 Deb.	4	87	—	4 12 0
Metropolitan	3½	3¼	—	5 12 5
do. 4½ per cent. Pref.	4½	4	—	5 12 6
do. 4½ Deb.	4½	94	—	4 15 9
do. 3½ Deb.	3½	75	—	4 13 4
St. James' and Pall Mall	10	8	—	6 5 0
do. do. do. 7 per cent. Pref.	7	6⅞	—	5 9 10
do. do. do. 3½ Deb.	3½	75	—	4 13 4
South London	5	3	—	6 18 4
South Metropolitan Pref.	7	1½	—	6 4 5
Westminster Ordinary	9	7½	—	6 0 0
do. 4½ Pref.	4½	4¼	—	4 12 4
Telegraphs and Telephones.				
Anglo-Am. Tel. Pref.	6	106½ xd	—	5 12 8
do. Def.	1½	22⅝	—	6 12 10
Chile Telephone	8	6⅜	—	5 18 6
Cuba Sub. Ord.	5	8⅜	—¼	5 17 8
do. Pref.	10	15½ xd	—	6 8 7
Eastern Extension	7	13⅜ xd	—⅛	*5 17 5
do. 4 Deb.	4	92	—	4 7 0
Eastern Tel. Ord.	7	132 xd	—1	*6 1 3
do. 8½ Pref.	8½	75⅛ xd	—	4 15 3
do. 4 Deb.	4	93	—	4 7 0
Globe Tel. and T. Ord.	6	11½	—	*6 2 0
do. Pref.	6	12	—	5 0 0
Gt. Northern Tel.	22	30 xd	—¼	7 6 8
Indo-European	65/-	54 xd	+½	6 0 4
Marconi	20	1 1/16	—	11 17 0
New York Tel. 4½	4½	98	—	4 11 6
Oriental Telephone Ord.	10	9	—	5 0 0
do. Pref.	6	1 3/16	—	5 1 1
Tel. Egypt Deb.	4½	88	—	5 2 3
United R. Plate Tel.	8	6⅜	—	6 3 1
do. Pref.	5	5	—	5 0 0
West India and Pan.	1	1 9/32	—1/32	7 11 0
Western Telegraph	7	13¾	—	*5 16 5
do. 4 Deb.	4	91	—	4 6 6
Home Rails.				
Central London, Ord. Assented	4	79	+½	5 1 3
Metropolitan	1½	29	—½	4 6 9
do. District	Nil	17	—	Nil
Underground Electric Ordinary	Nil	1⅜	—3/16	Nil
do. do. "A"	Nil	5/6	—	Nil
do. do. Income	6	79	—1	*8 14 0
Foreign Trams, &c.				
Anglo-Arg. Trams, First Pref.	5½	4 7/16	—	6 4 0
do. 2nd Pref.	5½	3⅝	—	7 2 0
do. 4 Deb.	4	81	—2	4 18 9
do. 4½ Deb.	4½	83	—	5 2 3
do. 5 Deb.	5	90	—½	5 11 1
Brazil Tractions	6	54	—1	11 2 2
Bombay Electric Pref.	6	10⅝	—	5 16 10
do. 4½ Deb.	4½	91	—	4 19 0
Mexico Trams	Nil	40	—	Nil
do. 5 per cent. Bonds	—	56	—2	Nil
do. 6 per cent. Bonds	—	37	—	Nil
Mexican Light Common	Nil	20	—	Nil
do. Pref.	Nil	41	—1	Nil
do. 1st Bonds	—	51	—	—
Adelaide Sup. 6 per cent. Pref.	6	5 5/16	+1/16	5 19 0
do. 5 Deb.	5	103	—	4 17 1
Manufacturing Companies.				
Babcock & Wilcox	14	51/-	—1/-	5 9 8
British Aluminium Ord.	5	20/6	—	4 17 7
do. Pref.	6	18/6	—	6 9 9
British Insulated Ord.	15	11½	—	6 10 5
do. Pref.	6	6½	—	5 0 0
British Westinghouse Pref.	7½	1 1/16	—	7 15 0
do. 4 Deb.	4	79	—	5 11 1
do. 6 p. lien	6	99	—	6 1 3
Callenders	15	12	—	8 6 8
do. 5 Pref.	5	5	—	5 0 0
do. 4½ Deb.	4½	98	—	4 12 4
Castner-Kellner	15	8½	—	4 12 6
Edison & Swan, £3 pd.	Nil	12/9	—3d.	Nil
do. do. fully paid	Nil	1⅞	—⅛	Nil
do. do. 4 Deb.	4	63	—	6 7 0
do. do. 5% Deb.	5	60	—	8 6 8
Electric Construction	6	14/-	+6d.	8 11 6
do. do. Pref.	7	1 1/16	+1/16	6 11 9
Gen. Elec. Pref.	6	10 3/16	—	5 17 8
Henleys	20	14½	—	*7 17 8
do. 4½ Pref.	4½	4⅜	—	4 12 4
do. 4½ Deb.	4½	97	—	4 13 9
India-Rubber	5	9⅛	—	5 9 7
Telegraph Con.	20	37	—½	6 9 10

Allowance made for dividends being paid free of income-tax.

Melbourne Electric Supply Co., Ltd.—The directors announce an interim dividend at the rate of 10 per cent. per annum, free of income-tax, on the consolidated ordinary stock for the half-year.

Willans & Robinson, Ltd.—The annual meeting was held on May 13th at Rugby, when the report was adopted. We shall report the proceedings next week.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING APRIL, 1915.

THE April returns of electrical exports from this country must be considered satisfactory, being but little below the comparatively high level of the previous month.

The actual totals were for April £382,610; for the previous month £391,850.

The April imports, valued at £230,752, show a considerable increase on the March total of £203,759; and the re-exports for April, at £11,167, compare with £8,297 last month.

While the previous month's export total benefited considerably from the inclusion of over £100,000 worth of telegraphic business, the satisfactory April total is due to improved export business in machinery, cables, telephonic material, lamps, &c.; the value of electrical machinery exports was approximately £150,000 for the month.

Practically every branch of the electrical imports expanded in value during April, but while Continental imports fell off on the whole, our American cousins increased their business with us by some £54,000 as compared with March.

Our best customers during the month were India, Argentina, and France, while good business was also done with our Australasian Colonies.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,686	3,296	172	74	430	1,546	10,622	737	744	77	411	766	20,561
Germany	...	...	...	...	...	...	...	...	...	...	...	...	...
Netherlands, Java and Dutch Indies ...	220	5,406	356	28	110	57	100	...	70	36	...	1,390	7,773
Belgium	...	...	...	...	...	...	...	...	...	...	...	...	...
France	863	...	684	261	936	189	3,479	954	233	22	16,297	11,708	35,626
Portugal	...	476	...	173	...	...	207	...	53	...	757	1,267	2,933
Spain, Canary Isles and Spanish N. Africa...	380	205	86	21	...	174	4,128	...	...	...	17	54	5,065
Switzerland, Italy and Austria-Hungary ...	772	...	40	23	...	123	3,430	...	80	81	4,386	612	9,547
Greece, Roumania, Turkey and Bulgaria ...	49	...	15	...	...	52	...	...	33	...	15,452	415	16,154
Channel Isles, Gibraltar, Malta and Cyprus...	24	...	153	98	...	14	299	154	17	20	56	66	901
U.S.A., Philippines and Cuba	210	...	163	22	...	...	1,936	...	655	...	48	352	3,386
Canada and Newfoundland	201	64	151	1,287	...	784	936	...	1,895	4	...	840	6,162
British West Indies and British Guiana ...	61	...	41	26	...	...	45	...	...	...	20	30	223
Mexico and Central America	145	383	...	17	...	35	92	...	...	...	...	...	672
Peru and Uruguay	...	621	13	...	...	...	...	...	14	...	89	14,510	15,247
Chile	197	...	155	250	...	16	4,703	175	...	...	...	1,285	6,781
Brazil	248	703	215	203	14	348	5,219	...	73	5	...	94	7,122
Argentina	454	9,476	2,209	663	...	268	2,689	24,699	820	15	2,692	1,363	45,348
Colombia, Venezuela, Ecuador and Bolivia...	...	248	31	32	...	...	...	...	14	...	21	23	369
Egypt, Tunis and Morocco	681	190	75	59	...	130	1,211	257	16	...	86	486	3,191
British West Africa	94	47	182	35	19	...	522	175	11	...	13	486	1,584
Rhodesia, O.R.C. and Transvaal	295	207	615	664	...	473	462	...	118	67	30	...	2,929
Cape of Good Hope	743	1,711	853	1,687	46	102	1,871	2,587	221	14	264	1,326	11,425
Natal	285	3,486	220	283	28	...	1,651	...	93	...	490	216	6,752
Zanzibar, Brit. E. Africa, Mauritius & Aden	116	260	120	211	...	...	2,051	...	153	...	93	238	3,242
Azores, Madeira and Portuguese Africa ...	33	207	...	100	...	20	440	13	...	21	...	381	1,215
French African Colonies and Madagascar ...	...	...	...	...	...	...	181	...	...	...	...	16	197
Persia	...	45	...	...	...	...	220	38	...	...	...	...	303
China and Siam	120	229	102	52	...	51	2,249	1,752	62	34	141	271	5,063
Japan and Korea	439	242	18	...	...	423	7,639	...	387	...	...	175	9,323
India	4,781	5,393	3,690	3,037	632	1,309	16,437	4,249	2,665	53	2,574	1,929	46,749
Ceylon	51	65	34	23	...	11	198	151	39	...	16	...	588
Straits Settlements, Fed. Malay States and Sarawak	651	1,732	199	433	111	...	547	808	408	77	194	448	5,608
Hong Kong	58	49	690	125	...	67	98	185	106	67	90	476	2,011
West Australia	144	503	110	59	...	33	161	...	108	...	19	67	1,204
South Australia	40	3,702	199	197	...	313	1,840	...	83	...	1,015	...	7,389
Victoria	4,551	3,403	1,451	1,200	...	963	16,577	479	716	15	2,227	2,254	33,836
New South Wales	1,233	4,589	792	1,508	28	694	4,686	7,612	1,837	...	3,844	719	27,542
Queensland	138	2,036	235	175	12	170	526	200	181	18	78	...	3,769
Tasmania	59	...	...	48	...	...	112	4,960	...	...	86	...	5,265
New Zealand and Fiji Islands	925	4,403	1,707	861	...	215	2,228	3,210	1,019	33	4,080	874	19,555
Total, £	20,947	53,377	15,912	13,935	2,366	8,580	99,792	53,395	12,924	659	55,586	45,137	382,610

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	391	...	16	35	589	...	1,941	109	876	794	739	5,490
Germany	...	...	...	...	...	...	...	...	...	...	...	...
Holland...	...	...	19	7,113	25	...	390	...	23	...	...	7,570
Belgium	...	...	...	...	...	...	...	...	...	...	...	...
France	428	...	416	207	81	461	1,302	...	4,568	2,810	95	10,368
Switzerland	1,342	...	4	265	...	1,345	4,408	768	18	1,029	95	9 274
Italy	993	7,280	...	...	50	51	729	446	...	186	139	9,874
Austria-Hungary	...	...	...	...	...	...	...	...	...	...	...	...
United States	10,258	7,411	886	1,365	7,459	192	17,452	119,364	2,373	10,333	7,109	184,202
Total, £	13,412	14,691	1,341	8,985	8,204	2,049	26,222	120,687	7,858	15,152	8,177	226,778

Additional imports.—Spain, electrical goods, £567; carbons, £3,017. South Australia, goods, £10. Canada, glow lamps, £190; arc lamps, £190.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above... ...	1,479	...	...	391	25	362	2,440	...	303	761	5,406	11,167

TOTAL EXPORTS: £382,610 TOTAL RE-EXPORTS: £11,167 TOTAL IMPORTS: £230,752

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third column contains many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

STANDARDISATION RULES FOR ELECTRICAL MACHINERY.

(Excluding Railway and Tramway Motors.)

In April, 1913, the Council of the British Electrical and Allied Manufacturers' Association adopted a code of rules for the standardisation of electrical machinery, which was published in our issue of May 23rd, 1913. These rules have now been re-issued, without alteration, as it is expected that the Engineering Standards Committee will shortly issue the first section of the new British standard rules—otherwise certain changes would have been made.

When the rules were first published, it was stated that additional sections were under consideration; these have now been incorporated in the code in the form of a supplement, which is reproduced below.

SUPPLEMENT.

Section VII.—Tolerances.

(1) A tolerance is the amount of permissible difference between the observed results and the guaranteed results.

(2) When the difference between the observed and the guaranteed results is not greater than the tolerance, it shall be considered that the guarantees have been met.

(3) In the event of the observed results differing from the guaranteed results by an amount greater than the tolerance, the penalty or bonus (if any) shall be taken only on the amount by which the observed deviation from the guaranteed results exceeds the tolerance.

(4) The "guaranteed" figure referred to is the figure written in the contract documents, and not that figure plus a margin or tolerance.

The following tolerances are recommended:—

(5) *For observations of temperature rise,* 2° Centigrade.

(6) *Efficiency.*—

(*a*) By steam consumption, 2½ per cent. on the guaranteed efficiency.

(*b*) Transformers (by summation of losses)—

Full-load efficiency.	Tolerance.
98 p.c. or higher	0.25 p.c.
Below 98 p.c.	0.4 p.c.

(*c*) Generators, motors, converters—

Note.—The following values apply to determination of efficiency by summation of losses. If the efficiency is to be determined by method of input-output test, the tolerances as shown should be increased one-half of 1 per cent. for guaranteed efficiencies not lower than 88 per cent., and they should be increased by 1 per cent. when the guaranteed value of efficiency is below 88 per cent.

Full-load efficiency. Per cent.			Tolerance. Per cent.
95 or above	... ...		½
Below 95	... ...		
not ,, 93	... ...		¾
,, 93	... ...		
not ,, 90	... ...		1
,, 90	... ...		
not ,, 85	... ...		1½
,, 85	... ...		
not ,, 75	... ...		2
,, 75	... ...		
not ,, 65	... ...		3
,, 65	... ...		4

(7) *Power Factor.*—

Full-load power factor. Per cent.			Tolerance. Per cent.
90 or above	... ...		2
Below 90	... ...		
not ,, 85	... ...		3
,, 85	... ...		
not ,, 75	... ...		4
,, 75	... ...		
not ,, 65	... ...		6
,, 65	... ...		8

(8) *Guarantees at Fractional Loads: Average-Load Guarantee.*—When guarantees are required upon performance at fractional loads, they should be given in the form of an "Average-Load" guarantee, thus:—

Full-load efficiency	... ...	× 4
Plus ¾ load ,,	... ...	× 3
Plus ¼ load ,,	... ...	× 2

The sum of these divided by 9 gives the "Average-Load" value.

The tolerances for "Average-Load" guarantees are those shown opposite similar values in the first column of the corresponding tables above.

(9) *Speed of Motors.*—

(*a*) With shunt characteristics (above 3 h.p.).—Tolerance, 5 per cent. above or below guaranteed speed at the temperature of full-load.

(*b*) With series characteristic.—Tolerance, 7½ per cent. above or below guaranteed speed at the temperature of full load.

(*c*) Slip of Induction Motors.—Tolerance, 50 per cent. on the listed value of slip.

(10) *Inherent Pressure Regulation Rise.*—

Tolerance, two-fifths of the value specified for regulation.

Section VIII.—Parallel Operation of Synchronous Machines.

In order to guard against unsatisfactory operation when alternators are run in parallel, it is necessary to satisfy two conditions:—

(1) There must be a limit to the amount of angular displacement from uniform running due to periodic irregularity in the turning moment of the prime mover. Such recurring angular displacement causes objectionable swinging of the ammeter needles, and, if excessive, will cause fluctuation in lighting, and throw out of step synchronous machines running on the system.

Note relating to Condition (1).

A periodic angular displacement of 2½ electrical degrees from position of uniform rotation with a machine of ordinary type will cause 15 per cent. to 20 per cent. exchange current; the angular displacement should not exceed this limit of 2½ electrical degrees. This limit will be exceeded if the cyclic speed-irregularity of the engine exceeds that given by the expression:—

$$\text{Cyclic speed-irregularity} = k/6p$$

where k = engine impulses per revolution
p = number of poles.

It is important that the expression indicating the degree of irregularity should be correctly understood. As most firms have approved the term "cyclic irregularity" with the definition

$$\frac{\text{Maximum speed minus Minimum speed}}{\text{Mean speed}}$$

members are recommended to adopt this term.

The irregularity should not in any case be worse than 1/150, otherwise there may be objectionable flickering in lamps and difficulty in running other synchronous machinery on the system. (In the case of a continuous current generator the limit of 1/150 to cyclic speed-irregularity also applies, but there is no further limit depending on the resulting angular displacement.)

(2) It is necessary to safeguard against hunting due to resonance between any periodic impulses of the engine and the natural oscillating frequency of the electro-mechanical system of which the generator forms a part. This may be met in either of two ways:—

(*a*) By providing a fly-wheel of such weight that the natural oscillating frequency is sufficiently different from the frequency of the engine impulses.

(*b*) By providing dampers on the generator to check the development of hunting due to resonance.

Note relating to Condition (2*a*).

The natural frequency of the machine when connected to the system should be at least 20 per cent. lower than the frequency of a possible irregular impulse. In a steam engine, either single or double-acting, and also in a two-stroke cycle, internal-combustion engine, this latter frequency corresponds to the crankshaft r.p.m., while in a four-stroke cycle engine the frequency is one half the crankshaft r.p.m. To meet this condition with machines of ordinary regulation, the total amount of fly-wheel effect required is given in foot-tons of stored energy at normal speed by the following formula:—

$$\text{Foot-tons} = 1.3 \times \text{poles} \times (\text{strokes per engine cycle})^2 \times \text{K.V.A.} \div \text{R.P.M.}$$

Note relating to Condition (2*b*).

Method 2*b* can only be relied upon so long as the coefficient of fluctuation of energy is kept within the limit specified below, but when this method is employed it avoids the necessity for the heavy and expensive fly-wheels required by method 2*a*, particularly in the case of slow-speed, gas-engine driven sets.

Electrical manufacturers guarantee satisfactory parallel operation only so long as the limit specified herein is not exceeded; if the limit is exceeded due to the engine misfiring, valves leaking, or other abnormal cause, method 2*b* cannot be relied upon.

The limit referred to above is as follows:—

The coefficient of fluctuation of energy should not exceed 10 per cent.

This coefficient is defined in the following manner:—

If a mean-effort line should be drawn, then the largest of the areas lying above or below the mean-effort line is called the fluctuation of energy, and the ratio of this area to the total area bounded by the mean-effort line over one complete cycle is the coefficient of fluctuation of energy.

Section IX.—Commutation.

D.C. machines must operate throughout the range from no load to the highest specified overload with fixed brush setting.

The operation must be practically sparkless from no load to full load, and without injurious sparking up to the maximum specified overload.

Section X.—Short-Circuit Tests on Alternators.

Sudden short-circuit tests should not be undertaken, nor guarantees given against short circuits in service, upon alternators which are required to have close inherent regulation, since such machines, due to their large flux and weak armature reaction, suffer most severely in case of short circuit.

Any regulator which will give close voltage regulation throughout the entire load range, will permit of the machine being designed with the proportions best suited to withstand short circuit. Hence close inherent regulation is an unnecessary requirement.

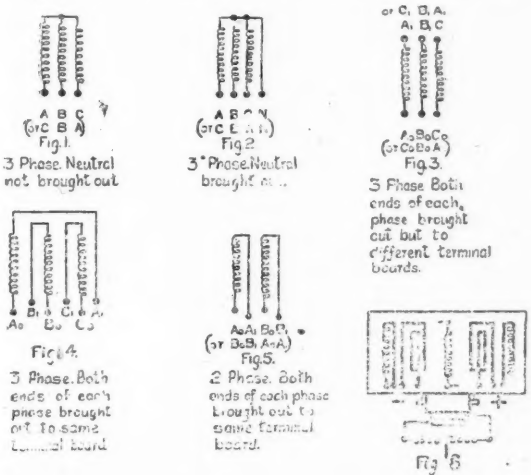
When, in the absence of restrictions as to regulation, it is still difficult to produce a design sufficiently self-protective, reactances may be employed, external to the machine, to assist in limiting the severity of the short-circuit current. (In case of machines wound for high voltage, external reactances are sometimes employed to protect the windings from voltage surges. Reactances, employed to limit the short-circuit current, may be arranged to serve as reactance screens for the last-mentioned purpose also.)

The severity of short circuit in any particular machine depends on the amount of flux, and not on the amount of excitation or load present at the instant. Tests should never be undertaken at a voltage higher than the normal for the machine.

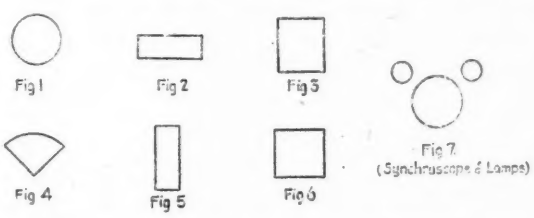
When making short-circuit tests, a solid contact should be made, as an arcing contact might cause puncture between the machine windings. If it is desired to reduce the effect of short circuit, reactance in preference to resistance should be used, or the voltage of the machine reduced, as resistance tends to improve the power-factor of the short circuit, and thus increase the mechanical shock upon the shaft.

Machines.

Arrangement and Markings of Terminals (see Section XII.).


A B C
(or C B A)
Fig. 1.
3 Phase. Neutral not brought out
A B C N
(or C B A N)
Fig. 2.
3 Phase. Neutral brought out
or C, B, A.
A, B, C
A₀B₀C₀
(or C₀B₀A₀)
Fig. 3.
3 Phase. Both ends of each phase brought out but to different terminal boards.
A₀ B₀ C₀
Fig. 4.
3 Phase. Both ends of each phase brought out to same terminal board
A₀A₁ B₀B₁
(or B₀B₁ A₀A₁)
Fig. 5.
2 Phase. Both ends of each phase brought out to same terminal board.
Fig. 6

Instrument Outline Symbols (see Section XIII., Rule 3.)



Note.—Other outlines may be made to indicate instruments of special shape.

Section XI.—Transformers—Terminal Markings.

Three-phase Transformers.

(1) *Lettering.*—The different phase windings are to be distinguished by the letters A, B, C, indelibly marked on their respective terminals.

Note.—It is recognised that with some standard makes of transformers it is not possible to arrange the terminals in the order A, B, C on both high-pressure and low-pressure sides, without introducing objectionable crossings amongst the leads within the transformer. Provided the terminals are properly marked in accordance with these rules, their actual position upon the case is of secondary importance.

(2) *Similar Letters on High and Low-pressure Windings.*—The same letters are to be used on the high-pressure and low-pressure terminals of similar phases.

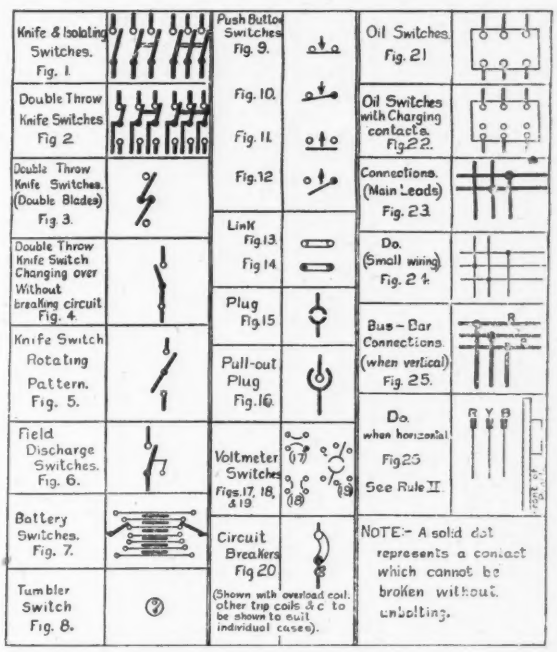
(3) *Distinction between High and Low-pressure Markings.*—The distinction between "high-pressure" and "low-pressure" terminals in any phase shall be made preferably by using small letters for the low-pressure markings, and capitals for the high-pressure markings. It is, however, permissible to indicate the low-pressure winding by the use of capital letters with a circle around each letter.

(4) *Marking of Polarity.*—The relative polarity of the two ends of every winding will be shown by the addition of the markings 0 and 1 after the phase letters.

(5) *Polarity of Low-pressure with respect to High-pressure Markings.*—The terminal marked 1 will be referred to as the positive end of the winding.

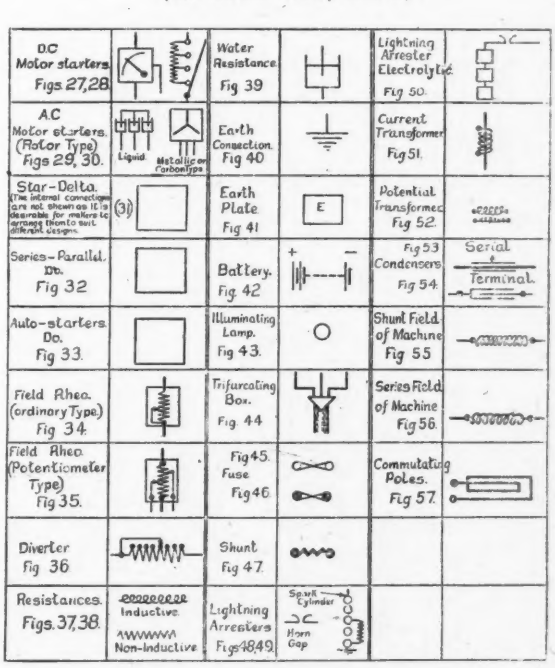
Symbols for Switches and Connections.

(See Section XIII., Rule 5.)


Knife & Isolating Switches. Fig. 1.
Double Throw Knife Switches Fig 2.
Double Throw Knife Switches. (Double Blades) Fig. 3.
Double Throw Knife Switch Changing over Without breaking circuit Fig. 4.
Knife Switch Rotating Pattern. Fig. 5.
Field Discharge Switches. Fig. 6.
Battery Switches. Fig. 7.
Tumbler Switch Fig. 8.
Push Button Switches Fig. 9.
Fig. 10.
Fig. 11.
Fig. 12
Link Fig. 13.
Fig. 14
Plug Fig. 15
Pull-out Plug Fig. 16.
Voltmeter Switches Figs. 17, 18, & 19
Circuit Breakers Fig 20
(Shown with overload coil. other trip coils &c to be shown to suit individual cases).
Oil Switches. Fig. 21
Oil Switches with Charging contacts. Fig. 22.
Connections. (Main Leads) Fig. 23
Do. (Small wiring) Fig. 24
Bus-Bar Connections (when vertical) Fig. 25.
Do. when horizontal Fig. 25
See Rule II.
R Y B
NOTE:- A solid dot represents a contact which cannot be broken without unbolting.

Symbols for Miscellaneous Gear and Parts of Machines.

(See Section XIII., Rule 6.)



The polarity of the corresponding high-pressure and low-pressure windings must be so marked that the progression of the E.M.F. at any moment from A_0 towards A_1 is in the same direction as from a_0 towards a_1 (and similarly for phases B and C). That is to say, if the negative terminal of

the high-pressure winding is connected to the positive terminal of the low-pressure winding, the E.M.F. across the two remaining terminals will be more than that across the high-pressure winding alone.

(6) *Marking of Tappings.*—The markings 0 and 1 are placed on the two terminals which give normal voltage. Each tapping terminal will be marked with its fractional value in terms of the normal voltage; or with an arbitrary number, referring to the diagram under Rule 7. The employment of fractional-value markings upon the terminals when adjustment tappings are provided is left optional. When this marking is employed, the terminal marked 1 need not be at the extreme end of the winding. If this method of marking is not employed, the taps must be numbered arbitrarily, and the diagram to be provided must show the values of the different tappings. When the adjustment tappings are provided in connection with an independent section of the winding which may be reversed in polarity, this auxiliary winding shall take the same phase letters as the section to which it belongs, and its various leads and tappings will be indicated by arbitrary numbers.

(7) *Diagram Permanently Attached to Transformer.*—It is recommended that a diagram of internal connections showing the position of all leads and tappings shall be permanently attached to each transformer.

(8) *Marking of Tappings on the Switchboard Diagram.*—On the switchboard diagram adjustment tappings need not be shown.

SINGLE-PHASE TRANSFORMERS.

The high-pressure terminals will be marked T_0 T_1 and the low-pressure terminals will be marked t_0 t_1 in accordance with Rules 3 and 4.

The markings will be so applied as to give the relative polarity of high-pressure and low-pressure windings indicated in Rule 5.

Rule 6 regarding the marking of tappings applies also to single-phase transformers.

SECTION XII.—MACHINES—MARKING AND ARRANGEMENT OF TERMINALS.

(1) For A.C. machines, the letters A B C should be adopted to indicate the external connections of a three-phase machine, and the letter N should be used to indicate a neutral connection.

Where both ends of each phase are brought out, A_0 A_1 B_0 B_1 C_0 C_1 should be used to denote the three phases.

(2) The terminals of a synchronous generator should be arranged and lettered consecutively in the order of actual phase progression.

The lettering will therefore progress from either left to right, or from right to left, according to the direction of rotation (see figs. 1 to 5, p. 743).

(3) In the case of a standard A.C. motor, where the actual order of phase progression is usually not known, it is recommended that the phase terminals shall always be arranged and lettered in the order from left to right (see figs. 1 to 5, p. 743.)

Note.—Induction motors used with rotary converters are regarded as special, and are not subject to these rules.

(4) Terminals on large D.C. machines should be arranged in order of polarity from right to left, looking at the commutator. A standard generator has its positive terminal on the right and should be so marked (see fig. 6, p. 743).

(It is not necessary to mark polarity on motors.)

SECTION XIII.—RULES FOR SWITCHGEAR SYMBOLS.

(1) *Diagrams.*—In general diagrams, the apparatus should be drawn as viewed from the main operating position. Machines and cables in the station should be drawn as viewed from above.

(2) *Colouring and Arrangement of Phases.*—

(*a*) The arrangement of bus-bars should be such that the red and blue phases are outside, and the bars should be indicated in the order of the National Colours—Red, White (or Yellow), and Blue (R, Y, B).

(*b*) When arranged horizontally, the red phase should be at the top, or the bar farthest away as viewed by the operator from the main control position in any direction.

(*c*) When arranged vertically the red phase should be to the left, or the bar farthest away, as viewed by the operator from the main control position in any direction. (See figs. 25 and 26, p. 743).

(3) *Outline Symbols for Instruments.*—

(*a*) From the outline symbols shown on p. 743, a shape should be selected to suit the instrument. Within this outline will be placed the symbol letter or letters selected from the list, Rule (4).

(*b*) Instrument terminals if shown should be indicated by dots, the positions of which are varied to suit different makes of instruments.

(*c*) Any further features which are desired, such as auxiliary switches, instrument windings, instrument terminals, should be indicated by showing their appropriate symbols within the outline.

(4) *Symbol Letters for Instruments* (referred to in Rule 3*a*).

Ammeter	A
Voltmeter	V
Wattmeter (indicating)	W
Ampere-hour meter	A H
Recording (graphic)	
Wattmeter	G W
Ammeter	G A
Voltmeter	G V
and others similarly	
Integrating wattmeter	W H
Overload relay	O R
Overload constant time limit relay	O T R
Overload inverse time limit relay	O I R
Reverse relay	R R
Additional letter may be added if desired to indicate a special feature, as	R P R (Reverse power) / R C R (Reverse current)
Power factor indicator	P F I
Synchroscope	S
Frequency indicator	F
Earth plate	E
Neutral (D.C.)	±

(5) *Symbols, Switches, and Connections.*—

(*a*) The symbols to be employed for switches and connections are shown on p. 743.

(*b*) Fixed contacts are represented by dots; movable contacts are represented by circles. A solid dot represents a contact which cannot be broken without unbolting.

(6) *Miscellaneous Gear.*—The symbols to be employed for miscellaneous gear are shown on p. 743.

TECHNICAL EDUCATION IN INDIA.

[FROM OUR SPECIAL CORRESPONDENT.]

A good deal has been said and written about this subject of recent years in India; and a good deal has been done by the various technical colleges to turn out the sort of Indian engineer required to fill vacant engineering posts. The colleges which perhaps have done most are the Victoria Institute, in Bombay; the Sebpier Engineering College, in Bengal; the Thomason College, in Roorkee; and, of more recent date, the Engineering College in Madras and Mysore. Much, however, remains to be done, and it is due to the Roorkee College to say that serious efforts are being made to induce the right kind of students to come forward and prepare themselves for a useful engineering career, in which there are increased openings year by year. An official note is just being issued from Roorkee relating to the new technical classes for students who care to take up a thorough course of mechanical or electrical engineering. The note states as follows:—

"There is known to be a demand in India in the mechanical and electrical engineering profession for men who, after training in a properly equipped institute, are willing to gain their practical experience by apprenticeship on a living wage, to work with their hands, and to observe factory hours and rules. For the civil engineering profession men can be trained in an institute directly for the various grades, the engineer and the subordinate, but even then they will require a certain amount of practical training. In the mechanical and electrical engineering professions, which require very great practical qualifications, however carefully a man may be trained in a technical institute, he is useless to an employer of labour till he has had practical experience; all must work alike and must in all cases begin at the lowest stage and work up gradually in time. This employment is open to Indians of every caste and creed, grade of social position or education, provided the above conditions are observed, and the position to which a man can rise depends on his individual ability and perseverance. Students must thoroughly understand that they are totally unfit for any position of authority on leaving the institute, and that they must first of all be subjected to workshop discipline and learn under practical conditions the details of the work which they eventually hope to supervise. They must be prepared to go into mills, factories and workshops with the full knowledge that they will meet with serious opposition from men, perhaps socially and educationally their inferiors, but who,

because they have worked themselves up from the point at which the apprentices are now starting, are of much greater value to their employers than they are at present.

"Given equal practical qualifications a man with a sound education at a technical institute must in time rise to the higher posts of authority over those who have not had these opportunities; but with all, practical knowledge and grit must be present. It is to provide men of this calibre that the technical class is formed.

"The students in this class will be required at the end of their first year's course to specialise in one of the following branches:—

"1. Mechanical Engineering.

"2. Electrical Engineering.

"(1) Mechanical Engineering.

"The course in mechanical engineering is intended to qualify students, after a practical apprenticeship, for employment in engineering workshops, belonging to Government, railways, or private firms. The training at the College will be as practical as possible, giving students a working knowledge of the principles of power generation and transmission, of workshop processes and machine tools, of modern methods of workshop production and cost, and the preparation of working drawings and estimates. As the College cannot give a student a complete practical and commercial training, they must serve an apprenticeship in workshops after their college course, to qualify them for posts of responsibility. If the two years' apprenticeship is served in direct connection with the working of prime movers and steam boilers, apprentices on the conclusion of their apprenticeship, will, on the recommendation of their employers, be permitted to sit for the second-class engineer's certificate under the United Provinces Boilers Act, without previously sitting for the driver's examination. As there are openings for real mechanical draughtsmen in India, the course will also aim to qualify students to take up posts of responsibility in engineering drawing offices. It is not intended to train tracers or copyists, but men who, after acquiring experience, can initiate and improve designs and prepare estimates and working drawings for the shops.

"(2) Electrical Engineering.

"The course is arranged to prepare students for employment on electrical installation for lights, fans, and motors for machine driving, pumping, traction, and general power purposes.

"After obtaining the necessary practical experience by a two years' apprenticeship on commercial works, they should be qualified for employment as follows:—

"(*a*) Taking charge of electric light, fan and power installation (isolated plant), requiring knowledge of connecting-up, starting and running the various items of the plant, the application of working tests to keep the plant in good running order, and the making out of specifications for renewals and extensions arising in the ordinary course of working.

"(*b*) Contracting and tendering for supplying, wiring and fitting electric bells and telephones, lamps, fans and motors, where a public or private supply is available, requiring a knowledge of the use and fitting up of the above apparatus, and the special advantages of different types, also the tests which the work must satisfy in order to be passed.

"(*c*) Appointments in charge of sections of the plant or business of supply companies of engineering firms (shift engineers, mains engineers, etc.), requiring a general knowledge of erection, maintenance, testing and repairs.

"Candidates will be statutory natives of India not under 17 and not over 21 years of age. Having furnished certain testimonials as to character and proved certain educational qualifications, candidates will be required to pass an entrance examination, which will be held in June at Roorkee, Allahabad, Lucknow, Naini Tal, Mussoorie, Lahore, Rangoon, Nagpur, Shillong or Bankipur. The course will extend to five years. Three years will be spent at the College. At the end of the first session students will be required to choose one of the following branches to specialise in (1) mechanical engineering; (2) electrical engineering. For the remaining two years of the course students will, if possible, be formally indentured out to some employer in the branch they have chosen. On the conclusion of the five years' course a college certificate will be issued."

If the above opportunities succeed in attracting the right kind of man, then a real want will in due course be supplied. Some very first-rate Indian engineers have undoubtedly been turned out of the various Indian colleges, but the percentage of first-rate men to the total number of engineering students on the rolls is small indeed. It is to be hoped that the wide scope of the new Roorkee syllabus will gather in young men with the engineering instinct, and eventually send them forth fully equipped to take important positions in engineering posts in India, of which there are many.

There will for very many years yet be a good demand for European engineers from home to fill the more important posts.

THE POWER SUPPLY OF THE CENTRAL MINING-RAND MINES GROUP.

By J. H. RIDER, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *April 15th*, 1915.)

(*Concluded from page 707.*)

Electric Distribution.

The power company's electric supply is given at normal pressure of 2,100 volts and 525 volts at the consumers' terminals. The distribution switch-houses belonging to the mines are built either at right angles or parallel to the power company's transformer houses, and the supply terminals are brought just through the party wall. In parallel switch-houses the 2,100-volt switchgear is arranged in line at one end and the 525-volt switchgear in the same line at the other end. In right-angled switch-houses the 2,100-volt switchgear is arranged on one side and the 525-volt switchgear on the other, with a common operating passage between them.

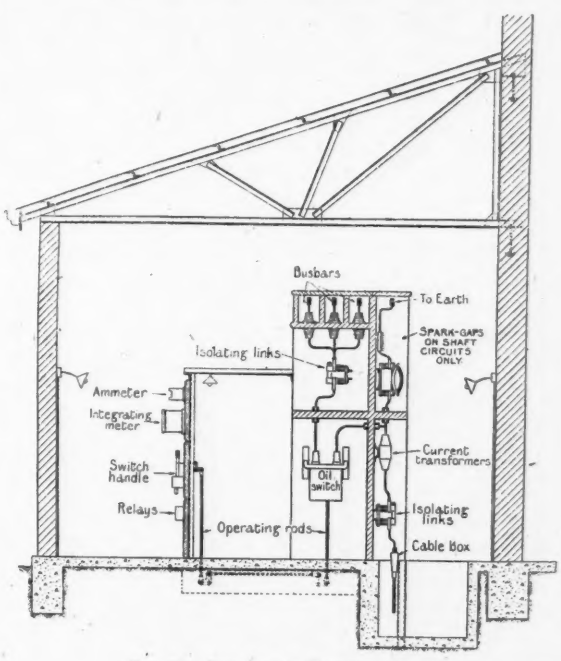


Fig. 7.—Section of Switch-house.

The arrangement of the original switchgear was very defective. There were no barriers between the different sets of apparatus, so that any arcing which might accidentally occur, either in a switch, transformer, or isolating link, was most likely to spread to adjacent apparatus. The bus-bars were quite unprotected, and there was nothing either to prevent the attendant, who might have to enter the passage behind the switchgear, from touching any part, or to save him from falling into the gear.

The need was obvious, but the difficulty was to provide a remedy without interrupting the supply. In those switch-houses which had any vacant space, new switchgear was erected at the end, and the circuits were changed over one at a time, so that as an old switch section was removed a new one could be built in its place. In other switch-houses an extension to the building had to be made before anything could be done. The whole change-over was a long process, but the result has well repaid the trouble.

In the majority of the switch-houses now in use the three bus-bars are carried in brick compartments at the top, and a separate brick cubicle is provided for each line of switch parts. The front slate panels are 2 ft. wide and contain an ammeter, an integrating watt-hour meter, and the switch control lever with its overload trip coil.

The latest form of switch-house is built parallel to the sub-station, and fig. 7 shows the design of switchgear employed. The cubicle arrangement has been developed to provide isolated sections for the different parts of the gear, so as to limit the result of any accident as far as possible. The cubicles are made of reinforced concrete. The new arrangement requires more space, but as the security of the whole supply depends upon the reliability of the switchgear, the little extra expense is thoroughly warranted.

The oil switches first used had been provided merely on a current-carrying basis for the full load of the circuit which they were to control. This is a very common but most erroneous practice, because it is so often forgotten that an automatic switch should be able to open the circuit with safety to itself under the worst conditions, which will probably be a short-circuit on the cables just beyond it. Frequent switch failures naturally followed. The rules now are: (a) that all oil switches in a switch-house shall be of the same size, (b) that such switches shall be rated for a current of 800 amperes at 15,000 volts, and (c) that no difference shall be made between the equipment of cubicles for 2,100-volt and 525-volt circuits, except in the current transformers and the meters. Since the above practice was instituted, trouble in switch-houses has practically disappeared.

Three-core, lead-covered and armoured cables, laid in trenches, are universally used between the main switch-house and the various sub-distribution points on each mine. The points are arranged to suit the local conditions, and are generally interconnected so that the failure of any main cable does not stop the supply. Link cages, without switches, are provided at the sub-points, so that the sub-circuits can be isolated at any time and the feeders interconnected as may be required. The largest cable used is of 0.5 sq. in. section per phase, and a separate panel for each feeder cable is provided in the switch-house. Where necessary several cables are run from the switch-house to individual link cages, and are operated in parallel.

Many and varied troubles have been experienced since the beginning of the power supply, quite apart from those which can be laid to the charge of the power company. They have been very costly in some cases and very annoying in all, and each and every one could have been avoided. The troubles have arisen from two main causes: (a) faults in design, and (b) faults in manufacture.

(*a*) *Faults in design.*—Want of stiffness in the stator frame has been found both in low-speed direct-coupled motors and in geared motors. The fault is a most serious one, and the remedy is obvious.

Some makers secure the stator core stampings by means of dovetailed strips screwed to the inside face of the frame. This is not nearly such good practice as to machine dovetailed slots out of the solid metal of the frame, into which the dovetailed projections of the stampings fit, as there is always the risk of the screwed strips getting loose under the severe racking strains to which the stator of a winding motor is always subject.

A number of 3-phase winding motors were supplied in which the dovetailed strips were "secured" by means of studs with nuts on the outside of the frame within the housing. No lock nuts or even spring washers were provided, and as the practice of the makers was to adjust the air-gap by means of the studs, the results can be imagined.

In motors by the same maker, the stator and rotor core-plates were clamped sideways by bolts passing right through, and the nuts were entirely hidden by the end loops of the coils. One motor was delivered in which the width of the stator core was 18⅜ in. on one side and only 18 in. on the opposite side, while the corresponding dimensions of the rotor core were 18⅛ in. and 17⅞ in. It was impossible to get at the nuts to tighten up the core-plates without first removing the windings. The proper way to secure core-plates sideways is to clamp them between stiff end plates and to use circumferential locking keys.

Cases were found in which the dovetailed slots were so wide that packing strips had been inserted to keep the core-plates from shaking. When complaints were made the maker asserted that it was not possible to machine so accurately as to avoid the use of such packings!

It is the practice of some makers to make semi-enclosed winding slots in the core plates by first punching a closed slot and then, when the whole core has been clamped up, to cut through the periphery of the core at the top of each slot by means of a saw. Quite a number of motors have been made in this way, and it was found that the result of the saw-cutting was to spring out the tips of the teeth on each side of each ventilating space, so that the spaces were almost closed in many cases. It was only by taking out the rotor that the fault could be seen. The correct way to make semi-open slots is to punch them out at one operation.

Difficulties were experienced in many cases from the type of distance piece used to form the ventilating spaces in the stator and rotor cores. This was a plain, thin steel strip, placed radially on edge and secured to one of the adjacent core-plates by simple riveting. The necessary pressure used in clamping up the core-plates was too much for many of the distance pieces and, instead of remaining firmly at right angles to the spaces, they bent over and partially collapsed. The area of contact between the edge of the strip and the face of the plate was in most cases found to be too small to take the pressure, and particularly where the core teeth were wide the teeth at the ventilating spaces were badly bent. Distance pieces of I section which are stiff and have a good bearing face on each side are now insisted on for all motors, and they should be spot-welded to at least one of the adjacent core-plates. They are easily obtained, as instanced by the fact that some makers never use any other form, but from the objections raised by other firms one would think their provision was not only impossible but also meant bad practice.

With a view to produce a 3-phase motor with a very high power factor, it is the almost universal custom to make the air-gap exceedingly small, and in many cases this is carried to excess. Instances of rotors of 6 ft. diameter with a radial air-gap of only 1 mm. are not unknown on the Rand, and when such motors also have stator frames which will not retain their shape without external struts, the matter becomes very serious from the operating point of view. Bearings will wear, and rotors and stators sometimes get out of truth; and it does not take very much in some cases to let the rotor down on to the stator. Then the customer blesses the motor maker.

A minimum radial air-gap = square root of rotor diam. in mm./20 − 0.25 in. mm. is now demanded for all moderate-speed motors, and manufacturing errors are not accepted.

A serious fault with many 3-phase winding motors is in the sizes of the rotor slip-rings and brushes. Contact areas which are large enough for motors in which the slip-rings are short-circuited and the brushes lifted as soon as full speed is reached, may be, and frequently are, quite insufficient when the brushes and rings are in use the whole time. A current density of not more than 60 amperes per square inch should be the maximum for carbon brushes.

A similar fault is to be found in the motors and generators of some Ward Leonard winders, and in this case the R.M.S. rating is not the controlling factor. The brush area should be based on the maximum current passing on accelerating the winder, which current is frequently twice the normal.

That slip-ring short-circuiting arrangements are generally very defective has already been mentioned. It would appear to be a difficult matter to design them so that a large area of contact can be provided in the space usually available, and so that the sliding collar which carries the contacts can be accurately centred and held free from shake and side movement when the brushes are lifted. A great deal of the difficulty would, however, be removed if the slip-rings were made only a few inches larger in diameter. The fact that the peripheral speed would be increased would be of no consequence, as the brushes are lifted at full speed. Flimsiness of design is the usual characteristic of 3-phase motor brush-gear.

The rating of oil switches was referred to in dealing with the switch-house arrangements. Is it too much to ask of makers of switchgear that they will rate their oil switches, not only at the maximum currents which these switches will safely carry continuously, but also at the maximum kilowatts at which they will safely break the circuit under normal voltage? They would probably burn up a few switches in obtaining the information, but they would then be in a position to supply apparatus which would really stand up to the conditions of actual service.

A fault in the design of some motors which have end-shield bearings is that the oiling ring is placed in a position where it can neither be seen nor reached.

Perhaps the most important point in connection with the design of motors and generators is that of the safe maximum working temperature. The altitude of the Witwatersrand is about 6,000 ft. (barometer 24.5 in.) above sea-level, and as the reiteration of that fact in hundreds of inquiries for plant seemed to have no meaning for some makers, recent specifications have had to call for a maximum temperature under test at sea-level which would give a safe working temperature at the mines.

The clause provides that no part of the motor, when working continuously at full load at sea-level, shall have a temperature rise exceeding 30° C., with the surrounding air at a temperature of 25° C. This corresponds approximately to a temperature rise of 35° C. at an altitude of 6,000 ft., with a surrounding air temperature of 35° C., or a total temperature of 70° C. (158° F.), which is quite high enough for any machine to work at continuously if a long life is to be obtained.

As the supply voltage can, and frequently does, vary between limits of 10 per cent. up and down from the normal, the lowest supply pressure must be taken for the purpose of the test.

The Engineering Standards Committee recently proposed that "a machine intended to operate between two limits of rated pressure shall have its rated current determined at the higher pressure." This would be fatal for motors intended for the Witwatersrand, or any other place where the supply pressure has considerable variations, as they must be able to work continuously with the larger current which is entailed by the lower voltage limit.

The great objection which most makers put forward to a lower temperature limit is that it would increase the cost of the motor, or it would mean the use of a larger frame, or any other reason which they can find to avoid giving the purchaser what the latter requires. Unless the customer insists on his requirements being met, the great competition between various makers will probably result in machines being supplied which are cut finer and finer every time. It is, of course, always assumed that the purchaser has an intelligent knowledge of his requirements, and that they are always reasonable. As an instance of the extent to which some firms will go in under-cutting, the representative of a very well-known firm once remarked to the author, relative to the sizes of the motors kept in stock by that firm, "Output plates are cheap."

Some manufacturers have not yet learned the important lesson, that in order to succeed they must be prepared to

supply what the customer wants and in the manner that the customer wants it, and not try to prove to the customer that he does not want what he wants, but what the manufacturers make. As a matter of fact few manufacturers make any real attempt to find the requirements of any particular market, and a still smaller number make any real attempt to meet such requirements. Then they express surprise when the market leaves them.

(*b*) *Faults in manufacture.*—For faults in design there may be the slight excuse that the designer is limited in his experience of the particular duty that will be required of the plant which he is designing. For faults in manufacture there can be none. What, then can be said of the under-mentioned list, the items of which are a few of many that have come under the personal knowledge of the author during the last four years, and all of which occurred in the work of firms of world-wide repute?

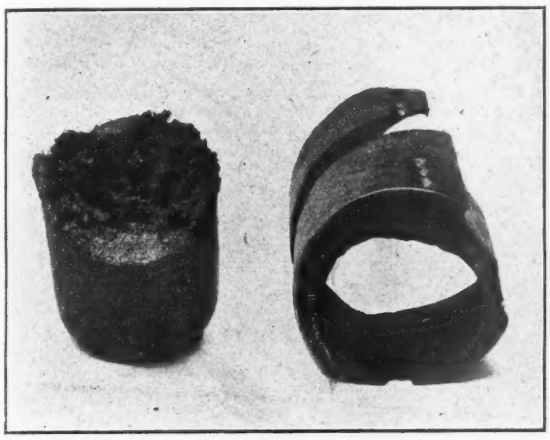


FIG. 8.—BROKEN SHAFT AND BROKEN BRAKE PIN.

In one case the several sections of a cast-iron bedplate of an electric winder would not fit together, even by persuasion, although the maker seriously stated that they had been perfectly fitted in his shops. Doubtless the higher temperature and relative dryness of the atmosphere on the Rand had something to do with it.

The shaft of a 100-H.P. motor, driving a tube mill, broke off just outside the coupling. The method of manufacture can only be guessed at from the right-hand object in fig. 8. The shaft had layers just like an onion, and these layers had apparently been wound on spirally and then welded together.

A steel pin, 3 in. diameter, supplied for part of the brake gear of an electric winder, showed one or two surface flaws when inspected on delivery. A slight blow with a hammer broke the pin in halves, with the result shown in the left-hand object in fig. 8. It proved to be made of cast-steel instead of forged steel, with a blowhole covering almost the full diameter. When it is remembered that men's lives would in all probability have been lost when the brakes had been applied a few times, some idea of the seriousness of the case will be obtained.

The instance of the 3-phase winding motor in which the dovetails were adjusted from outside has been mentioned. As no spring washers were supplied an attempt was made to make the nuts more secure by using them, and, for this purpose, the nuts were removed one at a time. On taking off one of the nuts the bolt end came away with it, and on examination it was found that the original bolt was only projecting through the stator frame for a depth of about two threads. A short bolt end had been screwed into the top of the nut to make it appear sound from the outside. There could be no mistake, as the two abutting ends did not in any way match.

Trouble had been experienced with the stator coils of some 3-phase, 2,000-volt winding motors, and the external taping of some of the end loops was removed. It was found that the slots were only three-quarters filled with wires, the rest of the space being empty. To make it appear that everything was all right, pieces of tape had been carefully screwed up and pushed for a short distance into the slots. These pieces were gradually tapered off where they followed the coil out, so that the external wrapping of tape gave a smooth finish right up to the core. Every other motor of the same size and make was then examined and found to be in a similar condition. It cost the maker a considerable sum to make the motors even passably right.

All stator coils for 2,000-volt motors are now required to be either semi- or completely-former wound, and to fill the slots completely.

The most costly trouble to either of the mines was the case of the breakdown of the motors of two large Ward Leonard winders, which failed from the same cause within a few hours of each other, and completely shut down a large shaft for four or five days. The spaces between the turns of the main-circuit coils on the auxiliary field poles had been filled up with some kind of pitch, and the whole was taped over. The armatures had open slots without wedges, and the coils were held down by a number of steel-wire bands. These bands broke away on two of the motors, some of the coils came out, and very bad breakdowns resulted.

When the top halves of the field magnet-systems were removed, lumps of hard pitch were noticed on the faces of the auxiliary poles, and these showed heavy scoring marks where they had rubbed on the armature bands. An examination of what was left of the bands showed that the first layer had been rubbed right through in some places. There could be no doubt that the pitch inside the coils had melted and run down, that it had set hard during the night and that when the winders were started up in the morning the wearing of the bands began. A further examination showed the original source of the trouble. The external connections between the auxiliary pole coils had been carefully taped up by the maker before the motors were delivered. They were found to have been made as shown at the top of fig. 9. The windings consisted of four copper tapes in parallel, and the cross-connections from pole to pole were made up from similar tapes. Each set of four had been bunched together, one set was laid on the other with a copper plate at the top and bottom, and four ocuntersunk-headed screws, ½ in. in diameter, were used

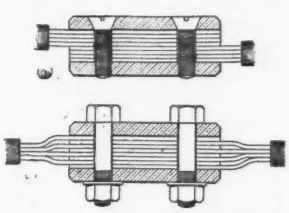


FIG. 9.—CONNECTIONS ON WINDING MOTOR.

to draw the parts together by a screwdriver. The surfaces of the tapes had been left dirty, the burrs made by the drilling had not been removed, and a number of the screws were found melted off. As the current was frequently as high as 5,000 amperes, this is not to be wondered at. The heat at the contacts had evidently made the whole coil so hot that the pitch had melted out and the breakdown quickly followed. The remedy was a simple one. The faces of the individual tapes were carefully cleaned and then interlaced as shown at the bottom of fig. 9. Hexagon-headed bolts and nuts instead of screws enabled a heavy pressure to be applied, and the joints now run quite cool.

Many other instances of bad work could be cited, but the above examples are characteristic and serve to show what even big firms will sometimes do if they are not carefully watched.

INSTITUTION OF ELECTRICAL ENGINEERS.

ANNUAL REPORT.

THE annual report of the Council, to be presented to the general meeting of the Institution on May 27th, has been published in the *Journal*, and states that at May 1st the membership amounted to 6,811 of all ranks, a decrease of 234 during the year. New members elected numbered 171, mainly students and graduates, and 16 were reinstated; 54 died, 123 resigned, and 244 (including 129 students) lapsed. Sixty candidates for Associate Membership have been approved subject to their passing the examination.

Military distinctions have been conferred upon Brigadier-General A. M. Stuart, C.B., R.E., Commander E. G. Robinson, R.N., and Second-Lieutenant G. W. Williamson, for their services during the war.

Three past-presidents have died during the year, namely: Prof. W. Grylls Adams, Mr. R. Kaye Gray, and Sir Joseph Wilson Swan. Seven members have died on active service, namely: Sapper J. A. Donald, Henry Labour, Major H. H. S. Marsh, Sec.-Lieut. J. L. Moffet, Sapper W. W. Pullen, Captain Guy L. Sclater, and Sec.-Lieut. Eric W. Wilson.

Premiums have been awarded as follows:—Mr. C. J. Beaver, Institution Premium; Mr. J. H. Rider, Ayrton Premium; Mr. H. G. Brown, Fahie Premium; Mr. E. B. Wedmore, John Hopkinson Premium; Dr. S. P. Smith and Mr. R. S. H. Boulding, Kelvin Premium; Mr. C. P. Sparks, Paris Premium; Messrs. W. M. Selvey and N. Shuttleworth, Extra Premiums; and Students' Premiums to Messrs. H. Hobson, A. Arnold, and H. S. Marquand. Salomons Scholarships have been awarded to Messrs. L. M. Barlow and C. D. Farmer, and a David Hughes Scholarship to Mr. P. D. Morgan.

A revision of the Wiring Rules is in progress. Over 2,500 copies of the revised Model Conditions for Contracts have been

disposed of. The Research Committee has made further progress, and interim reports have been published in the *Journal* on the heating of buried cables and the properties of insulating oils. The effective steps taken by the Council to assist the authorities are described, and it is stated that 928 members are serving in the Navy or the Army. The appointment of a committee to deal with the expansion of British trade is explained, in a passage which we reproduce in our leading columns.

A committee appointed to consider the periods of repayment allowed by the Local Government Board for loans to municipal authorities has recommended periods of 30 years in the case of underground cables, 60 years for conduits, 15 years for batteries, and 30 years for reinforced concrete, and the Council will make representations to the Board on these lines.

The Committee of Management of the Benevolent Fund reports that the capital account of the fund stood at £4,642 at the end of 1914. In response to a special appeal by the President, £318 has since been raised.

The annual accounts show an excess of income over expenditure of £1,624, compared with £2,833 in 1913. Mortgages have been reduced by £710 and now stand at £34,232, and the balance of assets over liabilities stands at £71,570, compared with £69,523 in 1913, an improvement of £2,047. There are now 11,085 volumes in the Library; there were 1,585 readers during the year, and 602 books were issued from the lending library.

Practical Aspects of Visibility.—In opening a discussion on this subject at a recent meeting of the ILLUMINATING ENGINEERING SOCIETY, MESSRS. C. C. PATERSON and B. P. DUDDING communicated the result of inquiries into conditions which, in some practical cases, prevent good visibility. The more interesting of the cases considered were: (1) The visibility of distant lights at night. (2) The visibility of objects illuminated by the beam of a searchlight or motor headlight. (3) The visibility of objects in close proximity to bright lights. (4) The relative visibility of objects by direct and indirect light. The question of visibility as distinct from invisibility is frequently bound up with the behaviour of the eye on the "threshold of vision." A variety of unusual factors exert their influence under very faint illumination, and, in such cases as the above, they are of great practical importance.

Sailors and railwaymen are concerned with the visibility at night of very small point sources of light. White masthead lights carried by steamers are supposed to be visible at 5 miles, and the red and green side lights have to be visible at 2 miles, which is about the limit attainable by oil burners; electric lighting is now common even on tramp steamers, and is subject to no such limitation. On an ordinary clear dark night, 1·6 C.P. is visible at 2 nauts, atmospheric absorption is unimportant and the inverse square law holds good. The intrinsic brilliancy of the source has no effect on its visibility. It is only the total flux of light that counts, until the source becomes so large or near that it subtends more than one minute of arc at the eye. The energy received per second from 1·6 C.P. at two miles is about 6×10^{-15} watt, and it is possible to stimulate vision with one-fourth of this power when the eyes are dark adapted.

In connection with motor headlamps and searchlights, if an object be visible at a certain distance under one illumination, more than four times that illumination is needed to make it visible at twice the distance, because the object itself then appears much smaller. From a series of interesting investigations, Messrs. Paterson and Dudding find that brightness for equal visibility must be proportional to the square of the distance from the observer so long as the object subtends less than 10′ arc (1 ft. at 100 yards); but for objects subtending a larger angle, the law suddenly changes and brightness for equal visibility is simply proportional to distance. This result, which does not accord with usual assumptions, appears to be well established by the authors' tests, and a reasonable theoretical explanation for it was advanced by Dr. Chalmers in the discussion. Probably for long-distance searchlight work 16 times the intensity is required to render objects visible at twice the distance.

It is interesting to note that under very severe conditions of "glare"—looking from a distance of 6 ft. at a point only 8 in. from a bare 20-C.P. lamp—no appreciable effect whatever was produced on ability to discriminate detail, so long as the equivalent surface brightness of the object was not less than 1 ft.-candle. These results do not affect the undesirability of glaring lights from other points of view, but indicate that glare has little effect on visibility of detail under ordinary conditions of lighting.

In conclusion, the authors pointed out that discrimination of detail on textile and other materials of uniform colour depends entirely on shadow, or the direction of incident light, so that indirect lighting is practically worthless in this respect. For discrimination of detail, and to avoid a monotonous effect, indirect lighting needs "helping out" by direct lighting.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

6,580. "Incandescent electric-lamp luminous and non-luminous resistances." J. J. RUSSELL & F. L. HARRISON. May 3rd.

6,586. "Thermic telephones and like instruments." R. AERNOUT, BARVON VAN LYNDEN, & NAAMLOOZE VENNOOTSCHAP DE NEDERLANDSCHE THERMO-TELEPHOON MAATSCHAPPIJ. May 3rd.

6,592. "Lamps." BRITISH THOMSON-HOUSTON CO., LTD. May 3rd. (General Electric Co., United States.)

6,593. "Sparking plugs." M. POGNON. May 3rd. (Convention date, May 28th, 1914, France.) (Complete.)

6,618. "Electric motors or dynamos." W. H. SCOTT. May 3rd. (Divided application on 16,093/14. July 6th.)

6,619. "Brush-gear for electric motors or dynamos." W. H. SCOTT. May 3rd. (Divided application on 16,093/14. July 6th.)

6,635. "Carbon-holder for electric arc lamps." L. GREENROYD. May 4th.

6,642. "Combined electric switches and connecting plugs." R. MOORE. May 4th.

6,665. "Means for regulating electric circuits." H. LEITNER. May 4th.

6,674. "Leakage-protection device for electric cables." C. J. BEAVER & E. A. CLAREMONT. May 4th.

6,685. "Coin-operated electric supply apparatus." P. WESSEL. May 4th. (Convention date, May 4th, 1914, Norway.) (Complete.)

6,708. "Sparking plugs." J. A. KENNEDY-MCGREGOR. May 5th.

6,715. "Electrical generators for lighting mechanically-propelled vehicles." H. C. H. SMYTH. May 5th. (Divided application on 22,062/14, November 5th.)

6,723. "Equalizing field windings for multipolar dynamo-electric machines." E. ROSENBERG. May 5th.

6,731. "Windings for electrical apparatus." BRITISH THOMSON-HOUSTON CO., LTD. May 5th. (General Electric Co., United States.)

6,738. "Electrically-actuated tools." W. J. MELLERSH-JACKSON. May 5th. (Commonwealth Electric Tool Co., United States.) (Divided application on 21,145/14, October 17th.) (Complete.)

6,753. "Microphones for wireless telephony." G. A. NUSSBAUM. May 6th.

6,805. "Apparatus for the electric transmission of the energy of a heat motor to the driving wheels of a vehicle or the like." P. BILES. May 6th. (Divided application on 10,275/14, April 25th.) (Complete.)

6,807. "Stereoscopic X-Ray apparatus." BRITISH THOMSON-HOUSTON CO., LTD. May 6th. (General Electric Co., United States.)

6,813. "Means for amplifying the effects of small vibrations, for telegraphic and other purposes." A. ORLING & ORLING'S TELEGRAPH INSTRUMENTS SYNDICATE, LTD. May 6th.

6,818. "Automatic switches of electric train-lighting systems." W. KING. May 6th.

6,846. "Switches for electric lamps and the like." J. B. PORTWAY, JUN. May 7th.

6,848. "Electric diving-torpedo and life-raft." R. P. WILLIAMS. May 7th.

6,859. "Electrical surveying-instruments." A. W. SHARMAN. May 7th.

6,887. "Moulds for electrotyping." C. E. S. BELL & L. G. SCOTT. May 7th.

6,895. "Starting switches for electric motors." A. H. CURTIS, A. H. MACKLEY, & IGRANIC ELECTRIC CO., LTD. May 8th.

6,898. "Electrical connectors." A. P. LUNDBERG, G. C. LUNDBERG & P. A. LUNDBERG, & G. PEGG. May 8th.

6,930. "Electrical measuring-instruments." A. PHILLIP & L. J. STEELE. May 8th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

17,899. ELECTRIC SWITCHGEAR. J. A. Hirst & P. S. Brook. August 6th. (March 6th, 1914.)

1914.

9,123. JOINTS FOR METALLIC CONDUITS FOR ELECTRIC CABLES. Simplex Conduits, Ltd., & L. M. Waterhouse. April 11th.

9,554. ELECTRIC CABLES. C. J. Beaver & E. A. Claremont. April 17th.

9,582. ELECTRIC RAILWAY SYSTEMS. K. E. Stuart. April 17th.

9,637. TELEPHONE TRANSMITTERS. E. C. R. Marks. April 18th. (Electrical Experiment Co.)

9,768. ELECTRIC POCKET LAMPS. A. Veron. April 20th. (April 19th, 1913.)

9,832. ELECTRIC CLOCKS. F. F. Reid. April 21st.

9,856. RETURN CIRCUITS OF ELECTRIC RAILWAYS, TRAMWAYS, AND THE LIKE. British Thomson-Houston Co. & F. W. Carter. April 21st.

10,050. COMMUTATORS FOR DYNAMO-ELECTRIC MACHINES. W. S. Pyrah. April 23rd.

10,440. ELECTRIC CABLES. R. R. Stell. April 28th.

10,532. ALTERNATING CURRENT TRACK SIGNALLING. B. H. Peter. April 28th.

12,232. TELEPHONE CALL RECORDERS. D. J. McGauran. May 18th. (July 22nd, 1913.)

12,573. GOVERNING MECHANISM FOR WATER-GAS PLANT AND THE LIKE. British Thomson-Houston Co. May 28th. (General Electric Co.)

14,060. PORTABLE ELECTRIC BATTERY LAMPS. M. H. Goldstone. June 11th.

17,052. MEANS FOR SUPPORTING ELECTRIC LAMPS. M. J. D. Carter, G. Maurice, & M. J. Railing. July 18th.

24,604. VARIABLE SPEED DYNAMO-ELECTRIC MACHINES. A. H. Midgley & C. A. Vandervell. December 24th.

1915.

676. ELECTRIC ARC LAMPS FOR KINEMATOGRAPHIC PROJECTIONS. A. Zanotta. January 15th.

1,672. ELECTROLYTIC APPARATUS FOR THE PRODUCTION OF LIQUOR FOR BLEACHING AND OTHER PURPOSES. A. Holliday & G. E. Ward. February 2nd.